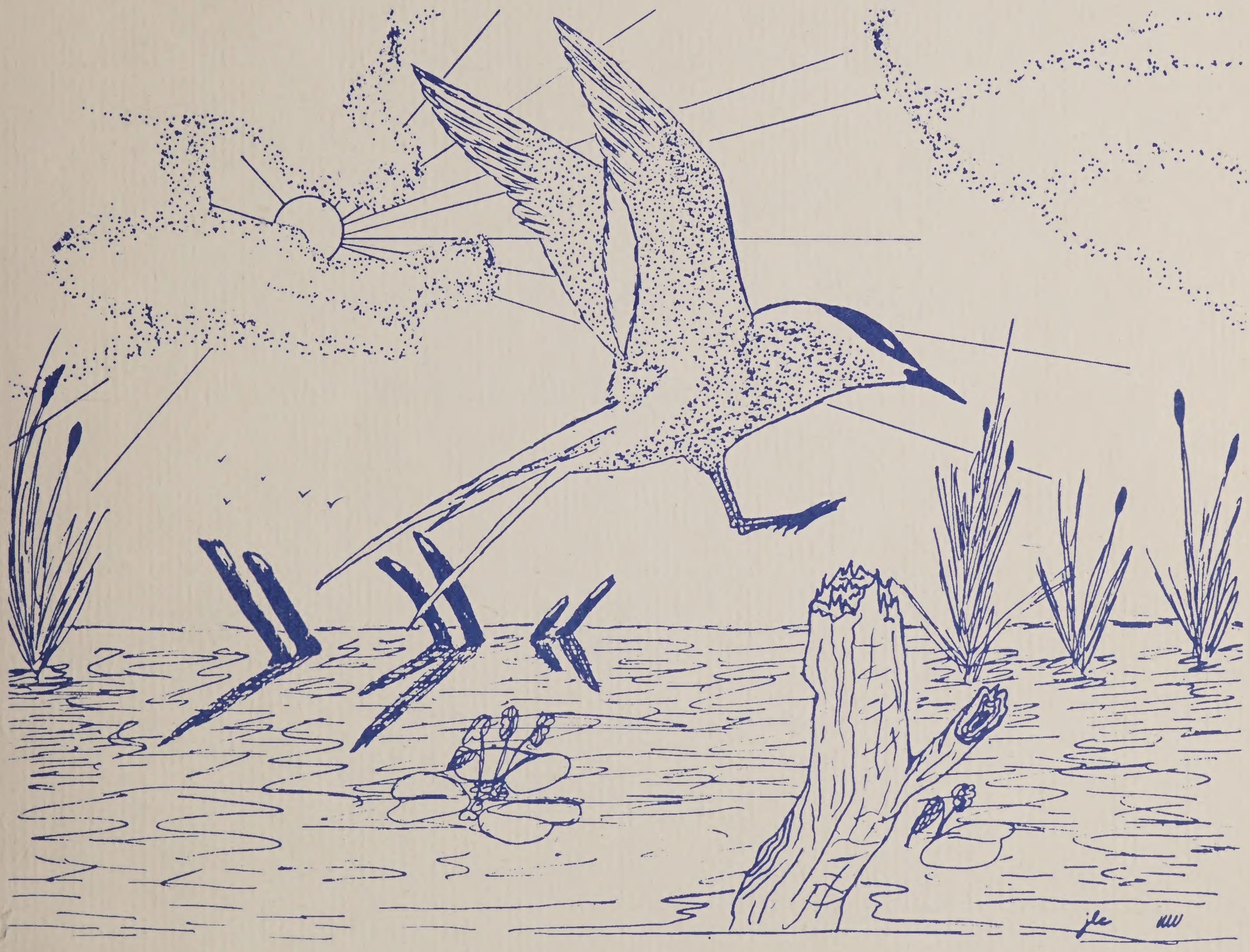
UNITED STATES DEPARTMENT OF THE INTERIOR

DRAFT ENVIRONMENTAL IMPACT STATEMENT



PROPOSED 1981 OUTER CONTINENTAL SHELF

OIL AND GAS LEASE SALE NO. 56

PREPARED BY:

THE BUREAU OF LAND MANAGEMENT

OUTER CONTINENTAL SHELF OFFICE

NEW ORLEANS, LA.

ERRATA SHEET

The Proposed Final OCS Oil and Gas Leasing Schedule dated March 1980 found on Page 20 should be replaced with the enclosed final schedule dated June 1980.

DEPARTMENT OF THE INTERIOR

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DIRECTOR
BUREAU OF LAND MANAGEMENT

SUMMARY

1. Preliminary Information

Proposed OCS Oil and Gas Lease Sale 56

Draft (X) Final ( ) Environmental Impact Statement

Comments due by:

September 12, 1980

Type of Action:

Administrative (X) Legislative ( )

Lead Agency:

United States Department of the Interior
Bureau of Land Management
Outer Continental Shelf Office
New Orleans, Louisiana 70130

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Area of Project Impact:

Coastal Counties of North Carolina, South Carolina, Georgia, and Florida

2. Description of Proposed Action

Proposed OCS Sale 56 is scheduled for August 1981 as the seventh sale of the new 5-Year Leasing Program. It would be the second OCS oil/gas lease sale held in the South Atlantic offshore region. The sale consists of 658,944 hectares (1,625,251 acres) offshore the states of North Carolina, South Carolina, Georgia, and Florida in 286 wildcat tracts located from 16-111 nautical miles from shore in water from 20-2,100 feet deep (see figure S-1).

The U.S. Geological Survey (USGS) has estimated that there are 1.4 billion barrels of oil and 2.5 trillion cubic feet of natural gas in the leasing area (conditional probability mean estimate); and that total development of these resources will require 101 exploratory wells, 56 production platforms, and 1,299 development wells. Exploratory drilling is expected to take place over the 7 year period from 1982-1989 while platform installation and development drilling should be completed between 1988 and 1994. Production is expected to peak in 1993 with average daily production rates of 327 thousand barrels of oil and 62 million cubic of natural gas.

It is assumed under the mean resource estimate development scenarios that oil and gas production will be gathered from offshore production areas and transported to shore through trunk pipelines. Up to 4 such pipelines are assumed; 2 with landfalls in Georgia and 2 with landfalls in North Carolina.

Additional assumptions include the use of from 2-7 temporary and from 2-8 permanent service bases; construction of up to 2 marine terminals and gas processing plants. Seven onshore areas are considered as the potential locations for these activities/facilities: Jacksonville, Florida; Brunswick and Savannah, Georgia; Charles-

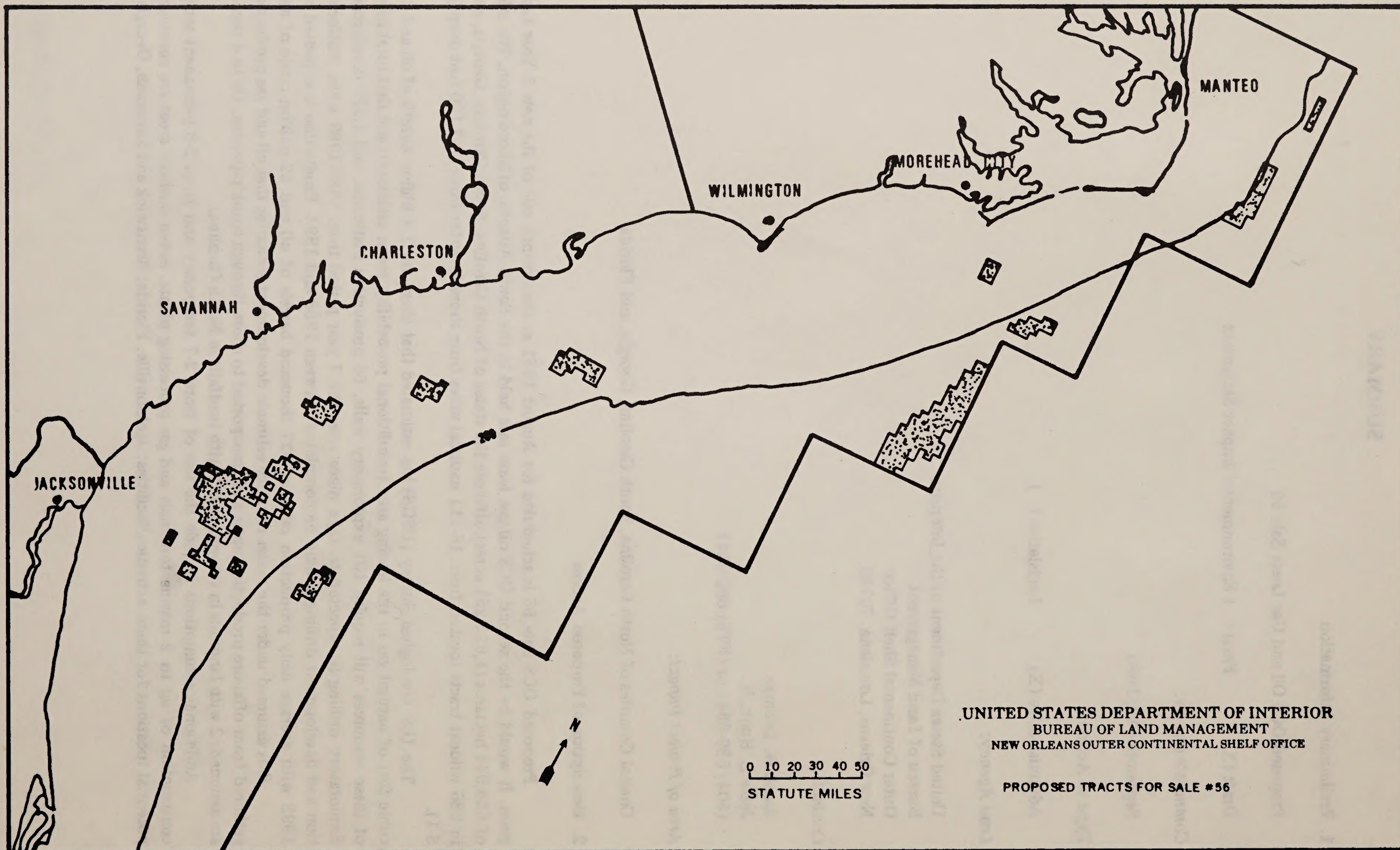

Figure S-1 — Tract Locations for Proposed Sale 56.

ton and Georgetown, South Carolina; and Wilmington and Morehead City, North Carolina. The use of existing oil refineries outside the local region, or proposed refineries in the local region, if constructed, is assumed.

The oil spill analysis conducted by the USGS indicates an expected 3.0 oil spills (greater than 1,000 barrels) occurring off the South Atlantic coast as a result of the proposed sale. The possibility that one or more oil spills will occur and contact land within 3 days is 0.11; for contacts within 30 days, the probability increases to 0.50.

3. Issues and Areas of Concern

Coordination with Other Agencies

As authorized by the OCS Lands Act, as amended, the Bureau of Land Management (BLM) and U.S. Geological Survey (GS) serve as the primary federal agencies administering this sale and coordinate with one another throughout the presale processes and the exploration phases. In addition, as lead agency the BLM has coordinated as appropriate with many cooperating federal, state, and non-governmental agencies and organizations in order to obtain resource data in their areas of expertise and to aid in the identification of significant issues and concerns to be addressed in the DEIS.

Determination of Significant Issues and Major Areas of Concern

One very important aspect of the Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act is the requirement for "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action." Chapter V outlines the various scoping actions taken by this office in conjunction with this proposed sale.

With regard to the public meetings held as part of the scoping process, the Governor's OCS coordinator in each state adjoining the proposed sale area was contacted in order to utilize state suggestions and to maximize public participation in the development of issues to be addressed in the DEIS. Accordingly, scoping meetings were planned, publicized, and held at Daytona Beach, Florida; Brunswick, Georgia; Charleston, South Carolina; and Manteo, Atlantic Beach, and Wilmington, North Carolina. The concerns voiced by attendees are listed in Appendix F.

As a result of the scoping process and coordination efforts, the following significant issues and major areas of concern were identified as the ones to be emphasized in the assessment process and in the DEIS:

Air Quality
West Indian Manatee
Commercial Fisheries
Live Bottom and Reefs
Community Services and Facilities
Recreational Fishing
Shoreline Recreation
Tourism
Water Quality

The impacts of OCS related activities and facilities on each of these issues and concerns is addressed in detail in Sections IV and summarized in Section II of this document. Appendix F contains the "Summary Impact Assessment" in which the expected level of impact resulting from the proposed lease sale is assessed for a larger number of environmental, social, and economic concerns.

4. Alternative Courses of Action and Related Environmental Consequences

a. Description of Alternatives

Four alternative courses of action are considered in this DEIS:

Alternative A — Holding the full sale as described above.

Alternative B — Reducing the size and geographic scope of Alternative A by deleting certain tracts thought to have a greater propensity to cause potentially adverse environmental consequences. Three deletion modifications are included in this alternative:

Modification B-1: This involves deletion of 42 tracts which may be either habitat areas for fisheries resources or be in close proximity thereto, so as to preclude any impacts or potential threats posed by developing the tracts.

Modification B-2: The 130 so-called deepwater tracts would be deleted due to the contention that they pose a higher risk of environmentally harmful accidents because drilling and development technology at these depths is still in the first stages of development and not considered sufficiently safe.

Modification B-3: This modification deletes all tracts within 30 miles of shore in order to preclude all associated potential environmental impacts. It is held that tracts within this distance of the shoreline pose a significantly higher risk of adverse impacts on nearby coastal resources and should not be developed for this reason.

Alternative C — Delaying the sale until a later date is an option which will be given serious consideration if it is determined that such a delay would significantly affect the expected environmental impacts of the proposed sale as described in the statement and/or the tracts selected for inclusion in the proposed sale.

Alternative D — No action; withdraw the sale. This alternative will be considered in the case that the potential or expected environmental and social costs of Alternatives A, B, or C that would result from development of the oil and gas resources, are greater than the estimated benefits to the nation as a whole.

b. Summary of Environmental Consequences

Alternative A - Hold the Sale as Proposed

Holding the sale as proposed will provide for a continuation of oil/gas exploration activities in the South Atlantic OCS which ultimately could result in the production of between 0.8-2.1 billion barrels of oill and between 1.4-3.5 trillion cubic feet of natural gas. This is judged to be a gain for the nation from both a standpoint of energy needs and the economic and political goals of independence from energy imports which contribute to a balance of payments deficit.

The following summary of environmental impacts relate to Alternative A:

— Air quality may be slightly degraded in the vicinity of offshore production sites and at onshore facilities.

— The West Indian manatee could be affected during the exploratory phase; if development/production activities result, further coordination under the Endangered Species Act will be required.

— Losses can be expected to occur to the commercial fishing industry but the magnitude of such losses are uncertain due to the factors involved, such as space use conflicts, potential oil spill sites, trawl hang-ups, etc.; however, the net loss after mitigation measures is expected to be minimal.

— Impacts to "live bottom" and reefal areas are considered to be negligible provided the biological stipulation is made a part of any lease resulting from this sale.

— Increased demand for, and consumption of community services and facilities related to OCS-generated population is expected to be met without significantly lowering existing service levels and standards. At worse, these increased demands could contribute to a minor short-term (1-3 years) impact on the quality of a public service in a particular local jurisdiction (the smaller communities would be more likely to experience this type of impact). The direct requirements of OCS development activities are not expected to create significant local problems in the onshore development areas. Revenues generated by OCS direct and induced activities are expected to be sufficient over the long-run to cover expenditures. However, some fiscal balance problems could arise in the short-term period.

— Recreational fishing could be enhanced, although there may be minor temporary adverse effects from pollution events and habitat modification.

— There is a very small risk that shoreline recreational resources will be appreciably affected by an oil spill occurrence.

— It is considered highly unlikely that the tourist industry will be seriously affected by a major oil spill; any adverse impacts that do occur are more likely to be localized and of short-term duration.

— It is likely that there will be temporary localized occurrences of water quality degradation near exploratory rigs or platforms and there could be localized minor long-term degradation of onshore water quality near industry facilities.

— The cumulative and additive effect of Sales 43 and 56 will be slightly greater than for Sale 56 alone, but the consequences will be essentially the same as postulated and analyzed for Sale 56 in this document.

Alternative B - Modify the Proposal Via Tract Deletions

Modification B-1: This modification allows for the deletion of 42 tracts or 15% of the total number of tracts included in Alternative A. Deletion of these tracts could reduce the total estimated oil and gas resources and other associated benefits of the sale by a proportional amount.

The following consequences relate to this modification:

— Potential adverse effects of OCS development on possible fisheries habitat occupying the same or nearby sites would be precluded. However, as discussed in Section IV.D.1.c.(1), the risk to commercial fisheries resources caused by development of these tracts is considered to be relatively slight and it is concluded that the modification will not significantly change the overall expected impacts to fisheries resources related to Alternative A.

— Preclusion of all other impact producing factors and related environmental impacts which could have resulted from development of these tracts. This could result in a 30% reduction in the impacts that could occur in the offshore, coastal, and onshore areas of North Carolina, and a 15% reduction in the total impacts of Alternative A. It should be noted that 39 of these 42 tracts are also included in Modification B-2.

Modification B-2: This modification would delete 130 tracts representing about 45% of the estimated oil and gas resources of the proposed sale.

The following environmental consequences related to this modification:

— The potential risks and impacts associated with oil and gas exploration, development, and production activities in these "deepwater" tracts would be precluded.

— A potential 90% reduction in the expected impacts that could occur in the offshore, coastal, and onshore areas of North Carolina, and a 45% reduction in the total impacts of Alternative A.

Modification B-3: This modification allows for deleting the 6 tracts which are located within 30 miles of the shoreline at Cape Fear, North Carolina. These tracts represent about 2% of the oil and gas resources of the proposed lease sale.

This modification would have the following environmental consequences:

— The potential risk of oil spills and resulting environmental damage to nearby coastal resources would be precluded from occurrence.

— A potential 5% reduction in the overall impacts that could occur in the offshore, coastal, and onshore areas of North Carolina, and a potential 2% reduction in the total impacts of Alternative A.

Alternative C - Delay the Sale

Holding the proposed sale at a later date could affect the analysis of environmental risk and expected impact so that the final selection of tracts for the proposed sale might be different. However, as a result of the scoping process and subsequent analysis it was determined that delay of the sale for 1-3 years would not significantly affect the tracts selected for Alternative A or the analysis of the risks and expected impacts which could result from holding the proposed sale.

Alternative D - Withdraw the Sale

Withdrawal of the sale would preclude all potential and expected environmental impacts of the proposed sale, as well as those of Alternatives B and C.

c. Comparison of Alternatives

The purpose of this comparison is to contrast the environmental consequences of the other five alternatives (B-1, B-2, B-3, C, and D) with Alternative A (Hold the Sale as Proposed).

Implementation of Alternative B-1 (Deletion of 42 Fisheries Tracts) would have the same general impacts of the proposal except:

(1) Any potential conflicts between commercial fisheries and oil/gas activities would be significantly reduced.

(2) The potential for oil spills and the construction of facilities in the North Carolina area would be reduced by 30%.

Implementation of Alternative B-2 (Deletion of 130 Deepwater Tracts) would have the same general impacts of the proposal except:

(1) Any potential risk of oil spills/loss of life from deepwater drilling activities would be precluded.

(2) The potential for oil spills and the construction of facilities in the North Carolina area would be reduced by 90%.

Implementation of Alternative B-3 (Deletion of 6 Nearshore Tracts) would have the same general impacts of the proposal except:

(1) The potential risk of nearshore oil spills would be significantly reduced in the Cape Lookout, North Carolina area;

(2) The overall potential for oil spills and the construction of facilities in the North Carolina area would be reduced by 5%.

Implementation of Alternative C (Delay the Sale) would temporarily preclude the environmental consequences of the proposal.

Implementation of Alternative D (Withdraw the Sale) would preclude the environmental consequences of the proposal for a greater time period than Alternative C.

Table S-1 provides a summary of the effect that the choice of Alternatives B, C, or D would have on the estimated impacts of the proposed sale (Alternative A) on each of the selected issues and major areas of concern.

The summary impact assessment for Altermtive A is described in terms of 3 components: the estimated risk or likelihood of an interaction occurring between the impact producing factors resulting from the proposed sale and the attributes of each issue or major area of concern, e.g., the likelihood of an oil spill directly resulting from the proposed sale contacting one or more West Indian manatee; the estimated risk or likelihood that, given the occurrence of an interaction, a significant adverse impact will result, e.g., the likelihood that, if an oil spill comes into contact with one or more West Indian manatee, it could have a significant adverse effect on the local or regional population; and the expected loss over the life of the proposed sale — this assessment can be based on quantified estimates of loss in monetary or other terms, or qualitative indicators of the level of loss.

With respect to the issue/concern categories "commercial fisheries," "West Indian manatee," and "live bottom/reef," a significant adverse impact is considered to be one that results in a significant long-term disruption of a regional or important local population or habitat of the specie(s) under consideration (for endangered species the definition means more specifically - jeopardizing the continued existence of a species in a particular region). This type of significant adverse effect is denoted as a HEL (High Ecological Loss) in the table.

With respect to other issue/concern categories, a significant adverse impact is denoted as HSL (High Social Loss), and is considered to be one that has significant short-run and/or long-run social costs.

Table S-1

Comparison of Alternatives

Significant Issues and Major Areas of Concern	Summary Impact Assessment Alternative A Hold the Sale as Proposed (286 Tracts, 100%)[6]: Risk of Interaction Occurring[1,4]	Risk of Significant Adverse Impact Given an Interaction[1,4,7,8]	Expected Loss Over Life of Sale[2,4,7]	Effects of Alternatives on Impacts of Alternative A[3] — Alternative B: Modification B-1 Fisheries (42 tracts, 15%)[6]	Modification B-2 Deepwater (130 tracts, 45%)[6]	Modification B-3 Nearshore (6 tracts, 2%)[6]	Alternative C: Delay the Sale (100%)[6]	Alternative D: Withdraw the Sale (100%)[6]
Air Quality	Possible	Very Unlikely HSL	Minimal	P/L, LD/R	P/L,MD/R	P/L, N/R	P	P
Commercial Fisheries	Unlikely	Very Unlikely HSL	Minimal	P/L, LD/R	P/L, SD/R	P/L, N/R	P	P
West Indian Manatee	Possible	Possible HEL	Minimal (possible HEL)	N	P/L	N	P	P
Live Bottom/Reefs	Very Unlikely	Very Likely HEL	Minimal	P/L,SD/R	P/L	P/L	P	P
Community Services/ Facilities	Very Likely	Very Unlikely HSL	Low	MD/L, LD/R	LD-SD/R	N	P	P
Recreational Fishing	Very Likely	Very Likely[5]	Gain[5]	P/L, L	LD-SD/R	P/L, N/R	P	P
Shoreline Recreation	Likely	Very Unlikely HSL	Low	LD/R	LD-SD/R	P/L, N/R	P	P
Tourism	Unlikely	Very Unlikely HSL	Low (possible HSL)	LD/R	LD-SD/R	P/L, N/R	P	P
Water Quality	Possible	Very Unlikely HSL	Minimal	P/L, N/R	P/L	P/L, N/R	P	P

1 - Risk or likelihood of an event is divided into five categories:
- Very Likely = Roughly 90-100% probability of occurrence
- Likely = Roughly 59 - 89% probability of occurrence
- Unlikely = Roughly 11 - 50% probability of occurrence
- Very Unlikely = Roughly 0 - 10% probability of occurrence
- Possible = Used when no information is available to assess the probability or improbability of an event (0-100%)

2- Expected Loss Categories:
- High Impact or Loss
- Moderate Impact or Loss
- Low Impact or Loss
- Minimal or Negligible Impact or Loss
- Uncertain Impact or Loss

3 - Effect on Impacts of Alternative A:
- P = Preclude impact
- SD = Significant decrease in impact
- MD = Moderate decrease in impact
- LD = Slight decrease in impact
- N = Negligible effect on impact
- L = Localized
- R = Regional or areawide

4 - Assumes protection and mitigation measures will be undertaken
5 - Beneficial impact
6 - Percent of total tracts affected
7 - HEL = High Ecological Loss
8 - HSL = High Social Loss

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Section I

The Proposal

I. THE PROPOSAL

A. Introduction

The stoppage of oil exports from Iran as a result of that country's political upheaval underscores our vulnerability and dependence on imported oil from all foreign sources. President Carter's Energy Message of April 5, 1979, reflected that fact and stressed the need for increasing our own resource production to gain independence from foreign oil. He set a primary goal for 1990 that our nation import only one-half of current rates. Development of OCS resources will have a positive impact on domestic production and aid in accomplishing the President's goal. Toward this purpose, the proposed sale is the second of three planned for the South Atlantic area and will provide between 0.8 to 2.1 billion barrels of oil and between 1.4 and 3.5 trillion cubic feet of gas.

The CEQ Regulations require that an EIS be prepared prior to a federal action as an aid in agency planning and decisionmaking. It also requires that alternative actions be considered. Besides the proposal to hold the sale, five other alternatives were addressed; i.e., potential tract deletion modifications, sale delay, and sale withdrawal. This DEIS will, therefore, address the range and scope of actions, alternatives, and impacts to be considered relative to this proposed South Atlantic sale. All potential impacts were analyzed and resulted in nine being deemed significant ones to be addressed in the statement. The remainder are included in Appendix F as "Impact Summary Assessment," in which an explanatory summary is given with their levels of significance indicated.

This statement deals with the South Atlantic area only; however, national implications for all OCS sales have been discussed in an EIS covering the Five-Year OCS Oil and Gas Lease Sale Schedule, published in January 1980, of which this sale was a part.

B. Scoping Process

The term scoping encompasses the overall consultation and coordination procedures of the leasing process and consists of several steps which are discussed in Section V and which are summarized below:

1. Requesting resource information for the general lease area from other federal agencies;
2. Requesting tract nominations from the oil/gas industry, and comments from federal, state and local agencies, and the public;
3. Environmental briefing, tract selection, and stipulation meetings with other federal, state, and public representatives;
4. Public scoping meetings to determine the significant environmental issues to be discussed in the DEIS; and,
5. A public hearing to receive comments on the DEIS, which are discussed in the FEIS.

As a result of the scoping process nine issues and six alternatives were selected as the most significant for analysis in this DEIS:

Selected Issues	Selected Alternatives
Air Quality	Alternative A - Hold the Sale
West Indian Manatee	Alternative B-1 - Delete 42 Fisheries Tracts
Commercial Fisheries	Alternative B-2 - Delete 130 Deepwater Tracts
Live Bottoms and Reefs	Alternative B-3 - Delete 6 Nearshore Tracts
Community Services and Facilities	Alternative C - Delay the Sale
Recreational Fishing	Alternative D - Withdraw the Sale
Shoreline Recreation	
Tourism	
Water Quality	

We recognize there are other concerns pertaining to this proposal and they are discussed in detail in the Summary Impact Assessment in Appendix F.

C. Description of the Proposal

1. Location and Resources

Proposed Sale 56 will offer 286 tracts totaling 658,944 hectares (1,628,251 acres) in Federal waters offshore North Carolina, South Carolina, Georgia, and Florida. These tracts range from approximately 16-111 nautical miles (29-205 km) offshore in water depths of approximately 20-2,100 meters (65-6,890 feet). Individual tract locations are shown in visual 1; tract data is listed in Appendix A.

U.S. Geological Survey has provided the following resource estimates for Proposed Sale 56:

	5%	Mean	95%
Oil (billions of barrels)	0.80	1.4	2.1
Gas (trillions of cubic feet)	1.4	2.5	3.5

The above numbers indicate that if the area is hydrocarbon productive, there exists a 5% probability that recoverable resources will be less than 0.80 billion barrels and 1.4 trillion cubic feet. There exists a 95% probability that resources will be less than 2.1 billion barrels and 3.5 trillion cubic feet.

The resource estimates are risked and their probabilities apply only to the tentative sale area as a whole. There is an additional geologic risk for the occurrence of hydrocarbons within any given structure.

The development estimates and scenarios for this proposal are discussed in Section IV.A. and B.

2. Mitigation Via Lease Stipulations

Oil/gas exploration and development activities on the OCS have the potential for causing negative environmental impacts; therefore, stipulations are attached as necessary, in the form of additional mitigating measures to those already in place. They apply only to tracts considered to have the potential for such harm.

Different types of stipulations can be attached, but for this proposal six stipulations are recommended. They are the archeological, biological, geological, military area, ordnance, and transportation stipulations. These will apply to all tracts in this proposal unless otherwise stated; the term "Supervisor" refers to the Oil and Gas Supervisor for the South Atlantic Operations of the U.S. Geological Survey and "Manager" refers to the Manager, New Orleans OCS Office of the Bureau of Land Management.

a. Archeological Stipulation

If the Supervisor, having reason to believe that a site, structure or object of historical or archeological significance hereinafter referred to as "cultural resource," may exist in the lease area, gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall upon receipt of such notice comply with the following requirements:

Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including, but not limited to, well drilling and pipeline and platform placement, hereinafter in this stipulation referred to as "operation," the lessee shall conduct remote sensing surveys to determine the potential existence of any cultural resource that may be affected by such operations. All data produced by such remote sensing surveys as well as other pertinent natural and cultural environmental data shall be examined by a qualified marine survey archeologist to determine if indications are present suggesting the existence of a cultural resource that may be adversely affected by any lease operation. A report of this survey and assessment prepared by the marine survey archeologist shall be submitted by the lessee to the Supervisor and to the Manager.

If such cultural resource indicators are present the lessee shall: (1) locate the site of such operation so as not to affect adversely the identified location; or (2) establish, to the satisfaction of the Supervisor, on the basis of further archeological investigation conducted by a qualified

marine survey archeologist or underwater archeologist using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation will not adversely affect the location identified or that the potential cultural resource suggested by the occurrence of the indicators does not exist.

A report of this investigation prepared by the marine survey archeologist or underwater archeologist shall be submitted to the Supervisor and the Manager for review. Should the Supervisor determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the Supervisor has given directions as to its preservation.

The lessee agrees that if any site, structure or object of historical or archeological significance should be discovered during the conduct of any operations on the leased area, he shall report immediately such findings to the Supervisor, and make every reasonable effort to preserve and protect the cultural resource from damage until the Supervisor has given directions as to its preservation.

Implementation of the Archeological Stipulation

After reviewing comments from state archeologists for the four South Atlantic states on the draft results of the South Atlantic Cultural Resources Baseline Study (SAI, 1979), a demarcation line was drafted (see visual 4) to divide the South Atlantic shelf into a high probability zone and a low probability zone for archeological site occurrence. This line takes into consideration both the probability for the occurrence of shipwrecks and prehistoric archeological sites. This line will be utilized as the primary factor in determining which tracts, if leased, will require a site specific survey as called for in Stipulation 1 and in accordance with the MOU between BLM and USGS entitled "Cooperative Procedures Between the U.S. Geological Survey (USGS) and the Bureau of Land Management (BLM) for Protection of Cultural Resources Related to Marine Oil and Gas Operations" (see Appendix G).

Archeological survey specifications are outlined in Notice to Lessees 78-2 (see Appendix H).

All areas identified from the remote sensing survey data as potentially containing significant historic or prehistoric archeological resources would either be avoided, protected, and/or identified and mitigated in accordance with prescribed regulations.

Based on the high/low probability demarcation line for archeological site occurrence, BLM intends to recommend to the Supervisor, GS, that archeological surveys be required on the following tracts should they be leased in the proposed sale: Tracts 40-45, 131-161, 175-212, 214-222, 224-275, and 277-286 (see figure I-1).

At the stipulation meeting for proposed OCS oil and gas lease Sale 56, held on February 5, 1980, an alternative archeological stipulation was proposed by representatives from the state of Georgia. This proposed stipulation reads as follows:

> If the Supervisor, *after consultation with the Bureau of Land Management, the Heritage Conservation and Recreation Service, and the South Atlantic States*, believes that a site, structure or object of historical or archeological significance, hereinafter referred to as "cultural resource," may exist in the lease area, and gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall upon receipt of such notice comply with the following requirements:
>
> Prior to any drilling activity or the construction or placement of any structure for exploration and development on the lease, including, but not limited to, well drilling and pipeline and platform placement, hereinafter in this stipulation referred to as "operation," the lessee shall conduct remote sensing surveys *using the latest state-of-the-art techniques* to determine the potential existence of any cultural resource that may be affected by such operations. *These survey transects should be spaced at a maximum of 45 meters between transect lines if side scanning sonar and magnetometer are used.* All data produced by such remote sensing surveys as well as other pertinent natural and cultural environmental data shall be examined by a qualified marine survey archeologist to determine if indications are present suggesting the existence of a cultural

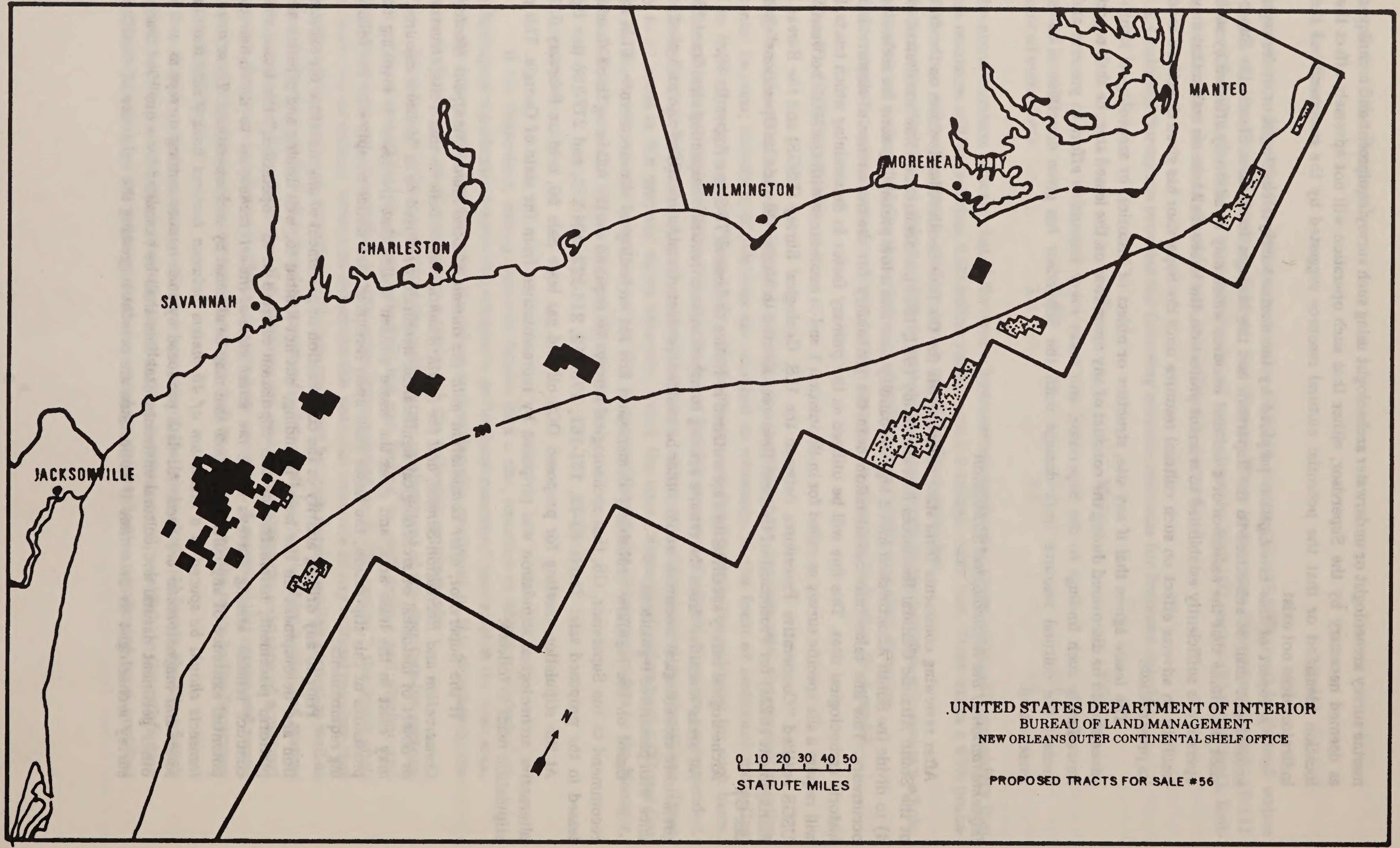


Figure I-1 — Tracts Recommended for Archeology Survey (solid black).

resource that may be affected by any lease operation. A report of this survey and assessment prepared by the marine survey archeologist shall be submitted by the lessee to the Supervisor and to the Manager for review.

If such cultural resource indicators are present the lessee shall: (1) locate the site of such operation so as not to adversely affect the identified location; or (2) establish, to the satisfaction of the Supervisor, on the basis of further archeological investigation conducted by a qualified marine survey archeologist or underwater archeologist using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation shall not adversely affect the location identified or that the potential cultural resource suggested by the occurrence of the indicators does not exist.

A report of this investigation prepared by the marine survey archeologist or underwater archeologist shall be submitted to the Supervisor and the Manager for review. The report will be made available to state agencies upon request. Should the Supervisor, *after consultation with HCRS and the Governors of the South Atlantic states*, determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the Supervisor has given direction as to its disposition.

The lessee agrees that if any site, structure or object of historical or archeological significance should be discovered during the conduct of any operations on the lease areas, he shall report immediately such findings to the Supervisor and make every reasonable effort to preserve and protect the cultural resource from damage until the Supervisor has given direction as to its disposition.

There are two major changes proposed in this alternative stipulation: (1) a statement outlining the consultation process, and (2) a change in the archeological survey specifications.

The proposed statement in the alternative stipulation concerning the consultation process is a general issue which is not specific to the archeological stipulation or the archeology program. This issue must be decided beyond the scope of the archeological stipulation and the BLM; therefore, it will not be addressed in this section.

It is proposed in the alternative stipulation that the survey line spacing be changed from 150 m as currently specified by NTL 78-2 to 45 m. A change in survey line spacing would more appropriately be addressed in a proposed revision to the NTL, which outlines survey specifications, rather than in the lease stipulation; however, since this issue has been raised in connection with the archeological stipulation it will be addressed in this section.

150 Meter Line Spacing

Notice to Lessees and Operators (NTL) No. 78-2 for the South Atlantic Area currently requires a line spacing of 150 m for a site specific survey when it is determined that an archeological interpretation is required. Cross-lines (tie-lines) are required at 600 to 800 m intervals. Although a survey is required only for each site specific action, most lessees choose to survey their entire lease since it is more cost effective and may prevent delays in lease development. Standard lease blocks in the South Atlantic are 4.8 km (approximately 3 miles) along each side. At 150 m line spacing, 33 survey lines with about 6 tie-lines are needed to meet the requirements for a single lease block. The resulting distance surveyed is approximately 120 line-miles and the approximate cost for such a survey currently averages around $80,000. Therefore the average cost of such a survey, including interpretation of data and a final report, runs approximately $700 per line-mile.

45 Meter Line Spacing

Some 108 survey lines and 6 tie-lines would be necessary to cover the same typical lease block at a line spacing of 45 meters. This spacing would result in coverage of some 353 line miles. At an average of $700 per line mile, the cost of such a survey would be around $247,000.

The above analysis assumes the same distance run "dead heading" (running from port of deployment to the survey area and return) the same weather down-time, etc. On the other hand, the 45 m survey would generate

about 3 times the survey data to be interpreted, requiring at least 3 times the amount of time required for interpretation. The total amount of time required for turning between transects would also increase by threefold. Of course, the time required for each survey would vary according to distance from port of deployment, weather conditions, water depth, etc.; however, in general terms it would be safe to state that decreasing line spacing from 150 m to 45 m would increase the cost of a typical survey from the neighborhood of $80,000 to around $247,000. For some tracts, this increased cost could conceivably make the difference in whether or not the tract is economically feasible for exploration.

(1) Navigation

Navigation systems currently used for this type of site survey are generally of the trisponder type and, for distances offshore which are greater than line-of-sight, these systems give operational accuracies at the navigational antenna on the vessel on the order $\pm$ 3 meters.

Certain equipment, particularly the magnetometer sensor and, to a lesser extent, the side scan sonar transducer, must be towed near the seafloor in order to obtain optimum results. For a hypothetical water depth of 30 meters, tow cable lengths must be a minimum of 100 meters in length, and frequently are longer. The distance from the navigation antenna to the sensor of a piece of equipment is known as "setback." The horizontal setback can be fairly accurately estimated by measuring the amount of tow cable deployed and multiplying the value by the cosine of the estimated angle of depression of the tow cable. Problems in estimating the setback occur when surface or subsurface currents which cross the vessel's track are encountered, which may be frequent in the marine environment. When such currents are encountered, the sensors may be located up to 20% of the setback distance to the side of the vessel tract in extreme cases, and this offset may not always be evident on the surface.

At 150 m line spacing, such offset represents only a small error in tract-made-good, but as line spacing is decreased, the significance of the error increases; and at 45-meter spacing, the error may represent one-half of the line spacing. The extra precision expected from this type of survey is not actually obtainable.

Precise location of the sensors could be attained through the use of transponders; however, this equipment is not commonly used on present surveys, and would require an additional cost. In the case of a magnetometer, any ferrous metal in the trisponder could affect the sensitivity of the instrument.

(2) Economics

At present, the 150 meter line spacing is utilized for mapping geologic hazards, biologic areas such as live bottoms, as well as mapping anomalous areas that could prove to contain archeological resources. Thus, if a cost were to be assigned out of the $80,000 block survey about $26,500 of this cost should be assigned to archeology since the survey serves, at least, a three-fold purpose in checking sea floor environment.

If the cost of surveying at the 45 meter line spacing for a block was elevated to $247,000 solely for the purpose of archeology, only $53,000 of that cost could be assigned to the collection of biologic and geologic data, leaving a cost of $194,000 per block assigned to archeology. In Sale 43, 224 blocks were offered and 43 blocks were leased (approximately a 20% success ratio).

In the case of Sale 56, 146 blocks are presently being analyzed for the EIS that appear within the high probability area for archeological site occurrence. If those 146 blocks were offered and a 20% success ratio realized as leases, 29 tracts would be leased that could have archeological survey requirements. Archeological survey costs could be assigned for Sale 56 as follows:

Line Spacing	Cost/Block	No. of Blocks	Total Cost
45 m	194,000	29	5,626,000
150 m	26,500	29	768,500

BLM has long been aware that archeologists use intensive search techniques when the survey objective is to acutally inventory shipwreck locations for a given area. An even more intensive survey grid is utilized in an intrasite survey to delineate and characterize a suspected wreck site, often followed by actual diving and testing

of the site. In contrast, the federal archeology program on the outer continental shelf is built on the legal mandates contained in the National Historic Preservation Act and E.O. 11593 to protect significant archeological resources from the adverse effects of federally permitted actions. This protection responsibility on the OCS (on which the federal government has never made legal claim to the archeological resources) has been complied with by requiring that the permittee either avoid areas showing evidence of potential archeological resources or conduct further investigation. In almost all cases, the permittee has chosen avoidance of possible archeological resources; therefore, little further investigation has been conducted and consequently little archeological data has been gathered as a result of these surveys. The 150 m line spacing for archeological surveys was chosen as a compromise between closer line spacing which would provide 100% magnetometer coverage and what was thought to be economically feasible. It was determined that if all unidentified magnetic anomalies were avoided by the distance to the next survey line (150 m), that it could reasonably be expected that potentially significant archeological resources are avoided by federally permitted actions. However, separate studies conducted by the State Underwater Archeologists for Texas and North Carolina indicate that at 150 m line spacing it is possible to pass by an historically significant shipwreck with no indication whatsoever on the magnetometer record (Clausen and Arnold, 1975; Watts, personal communication, 1980). Although 45 m line spacing would provide close to 100% magnetometer survey coverage, there would still remain the question of whether the magnetic signatures alone are sufficient to distinguish a potential shipwreck from areas of modern ferromagnetic debris. Also, assuming that such evidence would continue to be avoided by operators, rather than investigated, no more actual archeological data would be collected as a result of the surveys at 45 m line spacing than under the current system. Therefore, it is the recommendation of BLM to the Secretary that the first stipulation above be adopted.

b. Biological Stipulation

Oil and gas exploration and development activities have the potential for causing severe harm to certain productive and unique biological communities found on hard bottom areas and areas of significant topographical relief (These communities are discussed in Section III.B.). Stipulations have been developed to protect these communities from adverse impacts due to oil and gas activities and will be made a part of any lease resulting from this proposed sale which is on or sufficiently close to an area of biological significance upon which the biota of that area might be adversely affected by oil and gas exploration and development.

These stipulations have been developed during the past five years in consultation and coordination with the FWS and GS. In addition, advice has been received from other agencies, such as EPA and NMFS, as well as from the industry and other interested groups. Finally, in designing these stipulations, extensive use has been made of BLM funded studies and industry funded studies, including those monitoring studies in the Gulf of Mexico required by lease stipulations (i.e., Bright and Rezak, 1976, 1978a, 1978b; Mobil, 1975; other industry funded monitoring reports may be examined in the New Orleans OCS Office).

There are areas in the South Atlantic area having sea floors characterized by sparsely distributed rocky outcrops a few meters in relief. These "live bottom areas" (described in detail in Section III.B.) contain biological assemblages consisting of sessile flora and fauna which tend to attract or accumulate turtles and fishes; such areas are richer and more diverse and productive than the surrounding sea bottom and thus considered worthy of protection from the potential adverse impacts of oil and gas activities. These areas are not well known or mapped; thus, the stipulation applied in areas where live bottoms might occur requires the lessee to provide a bathymetry map of the area in which drilling is desired and will require the lessee to make an interpretation of any survey data (their own or the government's) for the possible presence of live bottom areas, and if the data indicates that live bottoms might exist in the area, the lessee will be required to submit photo or other documentation to substantiate that such areas are not present. If it is determined that drilling may take place in the area despite the presence of live bottom, the lessee will be required to take measures designed to protect the live bottom, which may include (but are not limited to) shunting, monitoring, or the transporting of all drilling effluents away from the live bottom area. This stipulation will be appended to and made a part of any lease resulting from this proposed sale.

A stipulation meeting for Proposed Sale 56 was held on October 29, 1979, attended by field representatives of USGS, USFWS, and BLM, at which the following biological stipulation was agreed to:

Prior to any drilling activity or the construction or placement of any structure for exploration or development on a lease, including but not limited to well drilling and pipeline and platform placement, the lessee will submit to the Supervisor as part of his exploration and/or development plan a bathymetry map, prepared utilizing remote sensing and/or other survey techniques. This map will include interpretations for the presence of live bottom areas within a minimum of 1,820 m radius of the proposed exploration or production activity site.

For the purpose of this stipulation, live bottom areas are defined as those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or whose lithotope favors the accumulation of turtles, fishes, and other fauna.

If it is determined that the remote sensing data indicate the presence of hard or live bottom areas, the lessee will also submit to the Supervisor photo-documentation of the sea bottom near proposed exploratory drilling sites or proposed platform locations.

If it is determined that live bottom areas might be adversely impacted by the proposed activities, then the Supervisor will require the lessee to undertake any measure deemed economically, environmentally, and technically feasible to protect live bottom areas. These measures may include, but are not limited to, the following:

(a) The relocation of operations to avoid live bottom areas;
(b) The shunting of all drillings fluids and cuttings in such a manner as to avoid live bottom areas;
(c) The transportation of drilling fluids and cuttings to approved disposal sites; and
(d) The monitoring of live bottom areas to assess the adequacy of any mitigation measures taken and the impact of lessee initiated activities.

At a second stipulation meeting, which was attended by representatives of the South Atlantic states in addition to the field representatives of USGS, USFWS, and BLM, held on February 5, 1980, those states (in a letter from Georgia dated January 18, 1980, to the Manager, New Orleans OCS Office, BLM), recommended the following biological stipulation:

Prior to any drilling activity or the construction or placement of any structure for exploration or development on a lease, including but not limited to well drilling and pipeline and platform placement, the lessee will submit to the Supervisor as part of his exploration and/or development plan a bathymetry map, prepared utilizing remote sensing and/or other survey techniques which employ the latest state-of-the-art technologies. This map will be included in the exploration and/or development plan submitted to the affected states for their review. This map will include interpretations for the presence of live bottom areas within a minimum one-mile radius of the proposed exploration or production activity site and within a minimum 200 m area on each side of the pipeline centerline.

For the purpose of this stipulation, live bottom areas are defined as those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or whose lithotope favors the accumulation of turtles, fishes and other fauna.

If after consultation with the Bureau of Land Management, the Fish and Wildlife Service and the South Atlantic states, the Supervisor determines that the remote sensing data indicates the presence of hard or live bottom areas, the lessee will also submit to the Supervisor photo-documentation of the sea bottom (so that objects on the sea floor are photo-identifiable) within a reasonable distance of proposed exploratory drilling sites, proposed platform locations or pipeline corridors. The photo-documentation will be at a representative fraction scale of 1:100 or larger (or 1" = 8.3').

If after consultation with the Bureau of Land Management, the Fish and Wildlife Service and the South Atlantic states, the Supervisor determines that live bottom areas might be adversely

impacted by the proposed activities, then the Supervisor will require the lessee to undertake any measure deemed environmentally, technically, and economically feasible to protect live bottom areas. These measures shall include, but are not limited to, the following:

(a) The relocation of operations away from live bottom areas;

(b) The shunting of all drilling fluids and cuttings in such a manner as to minimize potentially adverse impacts on adjacent live bottom areas, or the transportation of drilling fluids and cuttings to approved disposal sites; and

(c) The monitoring of live bottom areas to assess the adequacy of any mitigation measures taken and the impact of lessee initiated activities. This monitoring program shall be developed by the Supervisor in consultation with the Bureau of Land Management, the Fish and Wildlife Service, and the South Atlantic states and will include appropriate provisions for periodic reporting of results to these agencies.

From a biological point of view, this state proposal is identical to the earlier one developed by USGS, USFWS, and BLM field representatives: no additional requirements or restrictions would be imposed. The specification of the scale for the photo-documentation would be most appropriate to note in a USGS Notice to Lessees and Operators. For a photo to be useful for these purposes it will have to be at a scale larger than 1:100. The language regarding consultation is unnecessary because close coordination is mandated under the auspices of Secretarial Order No. 2974 and 30 CFR 250.34. Thus, it will be the recommendation of BLM to the Secretary that the first of the above stipulations be adopted.

c. Geological Stipulation

Stipulations as a result of geologic conditions which may be hazardous to petroleum exploration, development, and transportation will not be developed on a tract-by-tract basis until GS has completed their evaluation of geologic hazards. According to GS, this information will be made available to BLM 60 days prior to the release of the FEIS. A discussion of the geologic conditions in the proposed sale area is in Section III.A.7.

d. Military Area Stipulation

(1) Whether or not compensation for such damage or injury might be due under a theory of strict or absolute liability or otherwise, the lessee assumes all risks of damage or injury to persons or property, which occurs in, on, or above the Outer Continental Shelf to any person or persons or to any property of any person or persons who are agents, employees or invitees of the lessee, its agents, independent contractors or subcontractors, doing business with the lessee in connection with any activities being performed by the lessee in, on, or above the Outer Continental Shelf, if such injury or damage to such person or property occurs by reason of the activities of any agency of the U.S. government, its contractors or subcontractors, or any of their officers, agents or employees, being conducted as a part of, or in connection with, the programs and activities of the Commanding Officer, Fleet Area Control & Surveillance Facility, (OCEANA), Virginia Capes, Virginia, for tracts 1-130; Charleston Operating Area Coordinator (COAC), Charleston, South Carolina, for tracts 131-161; and Commanding Officer, Fleet Area Control & Surveillance Facility, Jacksonville, Florida, for tracts 162-286. The lessee assumes this risk whether such injury or damage is caused in whole or in part by any act or omission, regardless of negligence or fault, of the United States, its contractors or subcontractors, or any of their officers, agents or employees. The lessee further agrees to indemnify and save harmless the United States against, and to defend at its own expense the United States against all claims for loss, damage, or injury sustained by the agents, employees, or invitees of the lessee, its agents or any independent contractors or subcontractors doing business with the lessee in connection with the programs and activities of the United States, its contractors or subcontractors, or any of their officers, agents, or employees and whether such claims might be sustained under theories of strict or absolute liability or otherwise.

(2) The lessee agrees to control his own electromagnetic emissions and those of his agents, employees, invitees, independent contractors or subcontractors emanating from individual designated defense warning areas in accordance with requirements specified by the commander of the appropriate onshore military installation, Commanding Officer, Fleet Area Control & Surveillance Facility, (OCEANA), Virginia Capes, Virginia, for tracts 1-130; Charleston Operating Area Coordinator (COAC), Charleston, South Carolina, for tracts 131-161; and Commanding Officer, Fleet Area Control & Surveillance Facility, Jacksonville, Florida, for tracts 162-286, to the degree necessary to prevent damage to, or unacceptable interference with Department of Defense flight testing or operational activities, conducted within individual designated warning areas. Necessary monitoring, control, and coordination with the lessee, his agent, employees, invitees, independent contractors or subcontractors, will be affected by the commander of the appropriate onshore military installation conducting operatons in the particular warning area; provided, however, that control of such electromagnetic emissions shall in no instance prohibit all manner of electromagnetic communication during any period of time between a lessee, its agents, employees, invitees, independent contractors or subcontractors and onshore facilities.

(3) The lessee, when operating or causing to be operated on its behalf boat or aircraft traffic into the individual designated warning areas shall enter into an agreement with the commander of the appropriate onshore military installation, Commanding Officer, Fleet Area Control & Surveillance Facility, (OCEANA), Virginia Capes, Virginia, for tracts 1-130; Charleston Operating Area Coordinator (COAC), Charleston, South Carolina, for tracts 131-161; and Commanding Officer, Fleet Area Control & Surveillance Facility, Jacksonville, Florida, for tracts 161-286, utilizing an individual designated warning area prior to commencing such traffic. Such agreement will provide for positive control of boats and aircraft operating into the warning areas at all times.

e. Ordnance Stipulation

The lessee shall conduct remote sensing and/or other surveys as specified by the Supervisor to determine the existence of any unexploded ordnance (munitions, mines, or bombs). The lessee's report to the Supervisor should document all indications of magnetic or side scan sonar anomalies on the sea floor.

f. Transportation Stipulation

Pipelines will be required: (1) if pipeline rights-of-way can be determined and obtained; (2) if laying such pipelines is technically feasible and environmentally preferable; and (3) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. The lessor's decision regarding the selected means of transportation will be made within the context of an intergovernmental planning process for assessment and management of transportation of Outer Continental Shelf oil and gas with participation of federal, state, and local government and the industry. Where feasible, all pipelines, including both flow lines and gathering lines for oil and gas, shall be buried to a depth suitable for adequate protection from water currents, sand waves, storm scouring, fisheries trawling gear, and other uses as determined on a case-by-case basis.

Following the completion of pipeline installation, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the Supervisor. Where the three criteria set forth in the first sentence of this stipulation are not met and surface transportation must be employed:

All vessels used for carrying hydrocarbons to shore from the leased area will conform with all standards established for such vessels, pursuant to the Ports and Waterways Safety Act of 1972 (46 U.S.C. 391a).

The above transportation stipulation appeared in all of the Sale 43 leases. The following transportation stipulation is recommended by the state of Georgia:

> The lessor specifically reserves the right to select the least environmentally hazardous, economically viable, and technically feasible mode for transporting any crude oil and/or natural gas produced from the subject lease areas. After consultation with the Governors of the South Atlantic states, a decision regarding the means of transportation will be based upon the recommendations of the Regional Transportation Management Plan developed for this purpose by the South Atlantic Regional Technical Working Group Committee of the Outer Continental Shelf Advisory Board as established by the Secretary of the Department.
>
> Pipelines will be required: (1) if pipeline rights-of-way can be determined and obtained; (2) if laying such pipelines is technically feasible and environmentally preferable; and (3) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas.
>
> Where feasible, all pipelines, including both flow lines and gathering lines for oil and gas, shall be buried to a depth suitable for adequate protection from water currents, sand waves, storm scouring, fisheries trawling gear, and other uses as determined on a case-by-case basis.
>
> All valves, taps, or other irregular surfaces that might be vulnerable or might damage fishing gear will be buried to a minimum of one foot or to a suitable depth for adequate protection or covered with an approved protective dome which will allow commercial trawl gear to pass over the structure without snagging or damaging the structure or fishing gear.
>
> Following the completion of pipeline installation, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the Supervisor. Where the three criteria set forth above are not met and surface transportation must be employed, all vessels used for carrying hydrocarbons to shore from the leased area will conform with all standards established for such vessels, pursuant to the Ports and Waterways Safety Act of 1972 (33 U.S.C. 1221).

While in agreement with the transportation stipulation that appeared in all of the Sale 43 leases, the state of Georgia specified the covering of all taps, valves, or irregular surfaces with an approved protective dome which will allow commercial trawl gear to pass over the structure without snagging or damaging the structure or fishing gear. This is, in addition to the burial of all valves and taps at any water depth to a minimum of 1 foot below the mudline, an inherent part of the agreements to which compliance is required of an applicant requesting a right-of-way permit (OCS Pipeline Procedures, Part II, Section G-2, 132 et 1978).

There is no singularly approved design of a protective dome for the purpose previously mentioned. Therefore, the design of the type used by a subject firm to meet the requirements could be construed as satisfying the requirements. Therefore, it is the recommendation of BLM to the Secretary that the first stipulation above be adopted.

3. Other Mitigating Actions

The lease stipulations discussed in the preceding section are designed to protect sensitive biological resources, to protect known or suspected archaeological resources, to avoid accidents due to geologic hazards, and to avoid mishaps due to conflicts with military operations. These stipulations, in conjunction with OCS Operating Orders and Notices to Lessees, contribute to a minimization of adverse offshore impacts due to oil and gas operations. One measure of the effectiveness of these instruments is in the relatively low rate of spillage in non-frontier OCS areas. For example, during the period January 1, 1971 to December 31, 1975 a total of 5,857 oil spill incidents occurred in the Gulf of Mexico. The total volume spilled was 51,421 barrels, as compared to 1,811,333,779 barrels of oil and condensate produced during the same period. This gives a spill rate of 1 barrel spilled per 35,219 barrels produced, or 0.0028% (Danenberger, 1976).

In addition to the lease stipulations, other means of mitigating actual or potential adverse environmental and socio-economic impact are employed. These include programs to regulate discharges of certain effluents or other materials, to provide for timely and adequate response to spills, to provide for socio-economic planning in affected areas, and to reimburse fishermen for lost or damaged gear caused by OCS oil/gas activities or facilities.

a. Regulation of Discharges, Effluents, and Emissions

(1) Ocean Discharge Regulation

The Environmental Protection Agency (EPA) has proposed rules (45 FR 9548, published February 12, 1980) to establish ocean discharge criteria under Section 403(c) of the Clean Water Act. These rules will be used in reviewing and issuing permits under the National Pollutant Discharge Elimination System (NPDES). The goals of this system are to determine and minimize: (1) the effect of disposal of pollutants on human health or welfare; (2) the effect of disposal of pollutants on marine life; (3) the effect of disposal of pollutants on esthetic, recreation, and economic values; (4) the persistence and permanence of the effects of disposal of pollutants; (5) the effect of the disposal at varying rates, of particular volumes, and concentrations of pollutants; (6) to consider other possible locations and methods of disposal or recycling of pollutants, including land-based alternatives; and (7) to determine the effect of disposal on alternate uses of the oceans, such as mineral exploitation and scientific study.

Discharge permits may be approved on an individual, point-source basis or on a general or class basis for discharges involving similar types of operations resulting in discharges of the same types of wastes. EPA is considering issuance of a general permit for certain OCS oil and gas operations in non-sensitive marine areas.

(2) The Clean Air Act

The Clean Air Act, as amended in 1974 (42 U.S.C. 1851, et seq.), is intended to protect and enhance the quality of the nation's air resources, to initiate and accelerate a national research and development program to achieve prevention and control of air pollution, to provide assistance to state and local governments for air pollution prevention and control programs, and to encourage and assist the development and operation of regional air pollution control programs. Towards these objectives, the EPA has divided the country into Air Quality Control Regions (AQCR's), eight of which include coastal areas of the South Atlantic OCS area. Additionally, the EPA has promulgated national primary and secondary air quality standards for certain pollutants. All onshore operations and facilities will be required to comply with federal, state, and local regulations concerning air pollution control and prevention.

(3) Regulation of OCS Oil and Gas Related Air Emissions

The OCS Lands Act Amendments of 1978 (43 U.S.C. 1801) explicitly direct the Secretary of the Interior to control air pollution from OCS oil and gas activities which may significantly affect the air quality of coastal states. The U.S. Geological Survey is developing regulations which address the problem of potential onshore air quality degradation as a result of OCS oil and gas activities. The final rules concerning regulation of air emissions from oil and gas operations on the OCS were recently published (45 FR 15128, published March 7, 1980), and become effective in June 1980.

b. Oil Spill Prevention and Mitigation

Prevention and mitigation of oil spills is, and historically has been, a prime consideration in OCS resource management. Actions taken by the Department of the Interior include issuance of OCS Orders, mapping of existing pipelines and platforms in developed areas, and sponsorship of oceanographic studies leading to circulation models that will provide input in spill trajectory models. Actions taken by the EPA include their "pollution prevention program." The OCS Orders are discussed more fully elsewhere in this environmental statement, so will be only briefly addressed here.

(1) Platform and Pipeline Mapping

There exists in the Gulf of Mexico thousands of miles of pipelines within the OCS oil and gas producing areas. These pipelines are subject to occasional damage and potential breaks and resultant oil spills due to anchor dragging. One factor contributing to such incidents is the lack of accurate and detailed information on the location of these pipelines. The Department of the Interior is in agreement with the importance of such information and has prepared maps detailing all major pipelines in the Gulf of Mexico (U.S.) which are subject to the pipeline permitting process. The GS, BLM, and National Ocean Survey are also cooperating in a new mapping series showing pipelines and platforms at a scale of 1:250,000 UTM.

Should the proposed sale result in sufficient development to warrant pipelines, we anticipate that a similar mapping effort will be launched for the South Atlantic OCS.

(2) Circulation and Oil Spill Trajectory Modelling

The major uncertainties in protection against massive oil spills are "Acts of God" such as hurricanes or major storms, and facilities damage caused by unexpected severe geopressures which cannot be safeguarded against by engineering procedures.

The Department of the Interior oil spill risk analysis model has been applied to the South Atlantic OCS region to help mitigate the effects of these occurrences. The recent data from the BLM OCS Environmental Studies Program was used in the data base. The surface current vectors were determined from three years of radar altimetry data and the coastal wind data used in previous model runs were adjusted for offshore conditions through use of a transfer function. Additional work is planned to refine the offshore wind transfer functions.

A circulation model is being applied to the South Atlantic OCS region including the Blake Plateau. Ongoing studies are continuing to build a data base to be used in modelling. While the models can be used for real-time tracking or predictions of oil spill trajectories, their main purpose and use will be for diagnostic and statistical prognostic purposes. Mitigating measures can be planned and instituted before actual occurrences in order to alleviate any subsequent environmental consequences.

(3) EPA Oil Pollution Prevention Program

The Environmental Protection Agency administers a program entitled "Oil Pollution Prevention" to prevent oil discharges from onshore or offshore facilities other than transportation-related facilities. Such facilities include those involved in drilling, producing, gathering, storing, processing, refining, distributing, or consuming oil or oil products. The primary instrument of this program is a Spill Prevention Control and Countermeasure Plan (SPCC) which must be prepared by owners or operators of affected facilities. Guidelines for preparation of these plans are provided by the EPA (40 CFR Part 112) for the various types of facilities.

(4) U.S. Geological Survey OCS Operating Orders

OCS Opearating Orders Nos. 2, 5, and 8, with their references to API Recommended Practices and Standards, contain guidelines for assuring safe operations. Orders 2 and 5 include statements requiring use of "best available and safest technologies" for drilling operations (Order 2) and production safety systems (Order 5), in accordance with requirements of the OCS Lands Act Amendments of 1978. OCS Order 8 (Platform and Structures) includes requirements for verification of design acceptability in compliance with structural standards devised to assure safe operation under all environmental loading forces at the installation site. Environmental forces to be considered include unstable seafloor conditions, storms, earthquakes, tsunamis, hurricanes, and normal wind and wave forces.

c. Oil Spill Response Measures

Contingency plans for timely response to oil spills is required of the federal government by the National Oil and Hazardous Substances Pollution Contingency Plan, and of industry OCS oil and gas operators by USGS Operating Order No. 7.

(1) National Oil and Hazardous Substances Pollution Contingency Plan

To implement the Federal Water Pollution Control Act (FWPCA), the President's Council on Environmental Quality developed the National Oil and Hazardous Substances Pollution Contingency Plan. This plan was promulgated in final version and printed in the Federal Register (40 FR 6282) on February 10, 1975. The purpose of the plan is to provide for a coordinated and integrated response by agencies of the federal government to protect the environment from damaging effects of pollution discharges. The actual objectives of the Plan are to provide for efficient, coordinated, and effective action to minimize damage from oil and hazardous substances, including containment, dispersal, and removal. Provisions to accomplish these objectives include: (1) assignment of duties and responsibilities among federal agencies, in coordination with state and local agencies; (2) identification, procurement, maintenance, and storage of equipment and supplies; (3) establishment or designation of a strike force to provide necessary services to carry out the Plan and establishment, at major ports, of trained and equipped emergency task forces; (4) a system of surveillance and reporting designed to insure the earliest possible notice of discharges of oil and hazardous substances to the appropriate federal agency; (5) establishment of a national center to provide coordination and direction for operations in carrying out the Plan; (6) procedures and techniques to be employed in identifying, containing, dispersing, and removing oil and hazardous substances; (7) a schedule, prepared in cooperation with the states, identifying dispersants and other chemicals, if any, that may be used in carrying out the Plan; and (8) a system whereby the affected state(s) may be reimbursed for reasonable costs incurred in removal of spills. Affected states are actively involved in development of the contingency plan, and may be reimbursed for spill cleanup costs. There appears to be no provision, however, for direct funding to the states for development of containment or cleanup capabilities.

The FWPCA establishes the Environmental Protection Agency and the Coast Guard as enforcing agencies. These agencies have the authority and the capacity to marshall the nation's capability to combat an oil spill. They also share the responsibility to chair the Regional Response Teams established under the Plan. The Coast Guard's Atlantic Strike Team, based in Elizabeth City, North Carolina, is equipped with current state-of-the-art equipment designed to contain and cleanup oil in 5-foot seas, 20-knot winds, and 1.5-knot currents. Gear of this type has been proven effective in 10-foot seas and 40-knot winds, however. The Strike Team has the capability to deploy equipment and personnel within hours of notification of a spill.

(2) USGS Order No. 7 (Pollution Prevention and Control)

USGS Order No. 7 requires that the operator submit an oil spill contingency plan to the USGS Area Oil and Gas Supervisor prior to approval of permit application for conducting operations. This plan must be reviewed annually. The plan must contain assurances that full response capability is known and can be committed during an oil spill situation, including specification of appropriate equipment and materials, their availability, and time needed for deployment. The plan must also include provisions for varying degrees of response effort depending on the severity of the discharge, and provisions must be established for early detection and timely notification to responsible agencies and persons of a spill as well as specific response actions including identification of a trained, prepared, and available response operating team, pre-designation of an oil discharge response coordinator, pre-planned location for an oil discharge response operations center, and provisions for disposal of recovered spilled material.

A group of about 15 companies (membership varies from time to time) has formed a cooperative, Clean Atlantic Associates (CAA), to provide oil spill containment and cleanup equipment for use by member companies in the South Atlantic OCS and coastal waters, to maintain equipment at strategic locations in a state of 24-hour readiness, and to evaluate technological advances for possible inclusion in their equipment stockpile. The cooperative has established bases of operations at Davisville, Rhode Island, serving primarily the Mid-Atlantic OCS region, and at Brunswick, Georgia, serving primarily the South Atlantic OCS region. Either base may assist the other, if needed. CAA has contracted with Haliburton Services Company to stockpile and maintain equipment and to coordinate responses to a spill incident. Member companies base their individual USGS-required oil spill contingency plans on that of the CAA, and supplement it as appropriate for their planned operations.

A memorandum of understanding between the Departments of the Interior and Transportation outlines the respective responsibilities of the Geological Survey and the Coast Guard regarding the supervision of abatement, containment, and cleanup efforts required by this OCS Order. Essentially, the USGS is responsible for the

coordination and direction of abatement measures, while the Coast Guard is responsible for containment and removal operations.

d. Offshore Oil Spill Pollution Fund

The Offshore Oil Spill Pollution Compensation Fund, established by Title III of the OCS Lands Act Amendments of 1978, provides for cleanup costs and damages resulting from spills originating at OCS offshore facilities or surface vessels transporting oil from an offshore facility. The fund is generated by fees on OCS-produced oil (3 cents per barrel produced) and recompensed by claims against liable operators or owners of the facilities responsible for spills. The fund is to be maintained at a level of no less than $100,000,000 and no more than $200,000,000. Claims against the fund may be made for costs of spill cleanup and for damages caused by the spill.

e. Coastal Energy Impact Program

Section 308 of the Coastal Zone Management Act Amendments of 1976 pertains to the Coastal Energy Impact Program (CEIP). (Refer to Section I.D.1. for a discussion of the Act.) The program is a federal response to the government's recognition of its responsibility to aid those states where energy development has taken place to meet the nation's needs, and where such development has placed a strain on public services, existing facilities, and has resulted in financial stress. It is designed to provide state and local governments with grants and loans to prevent or mitigate the adverse impacts of OCS energy development.

Several types of grants or loans are available and include OCS Formula Grants, Environmental and Recreational Loss Grants, Planning Grants and Credit Assistance. In summary, OCS Formula Grants can pay up to 100% of planning and development costs for new or improved public services and facilities resulting from OCS oil and gas activity, such as police and fire protection, schools, roads, docks, water supply, hospitals, etc. Environmental grants aid in preventing, reducing, or repairing damage or loss to valuable environmental or recreational resources. Planning grants can be used for resource inventories, studies for social and environmental consequences of new or expanded facility sitings, and other energy activities affecting land use and transportation plans in the coastal zone. Credit assistance can be either in loans or guarantees for building new public facilities or on rare occasions to provide service for a short time period. Repayment assistance is available when local governments cannot meet CEIP credit assistance obligations because expected energy activity revenues did not materialize.

The following data indicates the cumulative allotments for FY 77 and FY 78 which have been paid to the South Atlantic states. (The figures are in thousands of dollars.):

	Planning	Formula	Credit	Env./Res.
Florida	358.1	58.5	1,896.5	26.1
Georgia	85.2	—	2,739.4	37.4
North Carolina	49.4	—	—	—
South Carolina	71.3	—	2,109.2	29.0

The OCSLA Amendments of 1978 (Public Law 95-372) amended the CEIP Program by adding the OCS State Participation Grant Program under new Section 308 (c)(2) of the CZMA to allow coastal states to carry out their responsibilities under the OCS Lands Act. The fund provides up to 80% federally funded grants to coastal states likely to be affected by OCS energy activity. The grants are to be used to cover the costs of participating in policy, planning and managerial decisions relating to the development of OCS oil and natural gas resources; they are not to be used to cover any of the site specific planning, construction, or property acquisition costs provided for in other provisions of the CEIP. These grants are authorized at $5 million a year for each fiscal year 1979 through 1983.

f. Fishermen's Contingency Fund

Final regulations (50 CFR Part 296) for the implementation of Title IV of the OCSLAA of 1978 were published in the Federal Register on Thursday, January 24, 1980, 45 FR 6062. The OCSLAA of 1978 estab-

lished this Fund to compensate commercial fishermen for actual and consequential damages including loss of profit due to damage or loss of fishing gear by various materials and items associated with oil and gas exploration, development, or production on the OCS.

As required in the Act, nine Area Accounts have been established, five are in the Gulf of Mexico, one in the Pacific, one in Alaska, and two in the Atlantic. The Mid-South Atlantic Area Account covers the area under consideration for proposed Sale 56. Each area account is initially funded at $100,000 and cannot exceed this amount. The account is initiated and maintained by assessing holders of leases, pipeline rights-of-way and easements, and exploration permits. These cannot be assessed more than $5,000 in any calendar year.

Generally, the claims eligible for compensation are as follows:

1) the damage or loss must be suffered by a commercial fisherman; and,

2) any actual or consequential damage (including loss of profits) due to damage or loss of fishing gear caused by items associated with oil and gas activities. Damage or loss that occurs in non-OCS waters may be eligible for compensation if the item causing the damage or loss was associated with OCS oil and gas activities.

Damage or losses ineligible for compensation are generally as follows:

1) damage or losses caused by items that are attributable to a financially responsible party;
2) damage or losses caused by negligence or fault of the commercial fishermen;
3) occurrences before September 18, 1978;
4) claim of damage to or loss of fishing gear is more than the replacement value of the fishing gear;
5) claims for loss of profits is excess of 6 months unless supported by records of the claimant's profits during the previous 12 months;
6) any portion damages claimed that will be compensated by insurance;
7) if the claim is not filed within 60 days of the discovery of the damage or loss; and,
8) the damage or loss was caused by a natural obstruction or an obstruction unrelated to OCS oil and gas activities.

There are several requirements for filing claims including a report within 5 days after the discovery of the damage or loss, stating among other things the location of the obstruction. This 5 day report is required to gain presumption of causation. A detailed claim form must be filed within 60 days of the discovery of the loss or damages. The specifics of list claim are contained in the Federal Register referenced at the beginning of this section. The claimant has the burden to establish all the facts to demonstrate the eligibility for the compensation, including the identity or nature of the item which caused the damage or loss and that the item is associated with OCS oil and gas activities.

Damages or losses are presumed to be caused by items associated with OCS oil and gas activities provided the claimant establishes that:

1) the commercial fishing vessel was being used for commercial fishing and was located in an area affected by OCS oil and gas activities;
2) the five-day report was filed;
3) no record of an obstruction in the immediate vicinity is in the most recent NOAA/NOS nautical charts or weekly Notice to Mariners; and,
4) no proper surface marker or lighted buoy marked the obstruction.

Damage or losses occurring within a one-quarter mile radius of obstructions recorded on charts or listed in the Notice to Mariners or properly marked is presumed to involve the recorded obstruction.

This Fund is being administered by the Financial Services Division, National Marine Fisheries Service, NOAA. This Fund should mitigate most losses suffered by commercial fishermen due to OCS oil and gas activities.

D. Administrative Events Leading to Proposal

1. Legal and Administrative Background

In 1953, the Congress declared that submerged lands of the continental shelf which extended seaward of a state (usually from the three-mile limit of the territorial seas) were federal lands. The Outer Continental Lands Act (67 Stat. 462) (OCSLA) established exclusive federal jurisdiction over the exploration, development and management of mineral resources located there. It also empowered the Secretary to formulate regulations so that provisions of the Act might be met. This jurisdiction was upheld in March 1975, in the Supreme Court decision U.S. vs. Maine, 420 U.S. 513 (43 L. ED. 2nd 263).

Subsequent to the passage of the OCS Lands Act of 1953, the Secretary of the Interior designated the Bureau of Land Management (BLM) as the administrative agency for leasing submerged federal lands (43 CFR 3300), and the Geological Survey (GS) for environmentally assessing and supervising any operations resulting from the proposed sale (30 CFR 250). The Department formulated three major goals for the comprehensive management program of marine minerals. These are:

(1) The orderly and timely development of marine mineral resources to meet the energy demands of the nation.
(2) The protection of the marine and coastal environment.
(3) The receipt of a fair return for the leased mineral resources.

These leasing objectives are based on legislative mandates as explained below:

a. Orderly and timely resource development is based on an approved 5-year planning schedule of proposed OCS lease sales (see figure I-2), evolved around the express intent of meeting the domestic demand for oil and gas, as well as meeting our national goal of decreasing our dependence on foreign resources. An FEIS for the most recent schedule has been published in January of 1980, and covers the period March 1980-February 1985. The OCS Lands Act gives the Secretary the authority to grant leases to the highest qualified bidder(s) on the basis of sealed competitive bids only after the DOI has completed a series of pre-leasing actions necessary to complete an EIS on which the Secretary's decision is made whether to hold the sale.

b. The policy of protection of the marine and coastal environment is a direct outgrowth of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). This Act required that all federal agencies shall utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences in any planning and decision-making which may have an impact upon the environment. More recently, the Council on Environmental Quality published regulations, effective July 30, 1979, which established uniform procedures for implementing the procedural provisions of NEPA by a process known as "scoping." This process seeks to identify the scope and significance of important issues associated with a proposed Federal action through interface with Federal, state and local agencies, the public and any interested individual or organization prior to the development of an impact statement as a means to reduce delays and produce better decisions. (See Section V and Appendix F for more detailed information.)

These regulations were not confined only to Sec. 102(2)(c) of NEPA, as were previous regulations, but apply to all nine subdivisions of Sec. 102(2). They were issued pursuant to NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 et seq.) Sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609) and Executive Order 11514, Protection and Enhancement of Environmental Quality (March 5, 1970 as amended by Executive Order 11991, May 24, 1977).

BLM responses to these requirements include the formation of Environmental Assessment Teams, interrelationships with other projects and proposals (see Section I.E.), development of Environmental Impact Statements (EIS's), and sponsorship of contract studies (see Appendix E). These studies include environmental benchmark studies, monitoring, and special studies designed to provide information for assessing the effect of oil and gas operations.

c. Receipt of a fair return has its basis in two separate mandates. United States Code 31, Sec. 483(a) obligates the Federal Government to obtain a fair return for public lands that are sold or leased. This is further implemented within the Executive Branch by the Office of Management and Budget Circular A-25.

PROPOSED FINAL OCS OIL & GAS LEASING SCHEDULE MARCH 1980

PROPOSED SALE AREA	PROPOSED DATE	1980	1981	1982	1983	1984	1985
A62 Gulf of Mexico	9/80	F P S_c R N S					
55 Gulf of Alaska	10/80	F P S_c R N S					
62 Gulf of Mexico	11/80	F P S_c R N S					
53 Central N. Calif.	5/81	E H F P	S_c R N S				
RS-1 Reoffering Sale	6/81		R N S				
A66 Gulf of Mexico	7/81	E H F	P S_c R N S				
56 South Atlantic	8/81	E H	F P S_c R N S				
60 Cook Inlet	9/81	E H	F P S_c R N S				
66 Gulf of Mexico	10/81	E H F	P S_c R N S				
59 Mid-Atlantic	12/81	E	H F P S_c R N S				
67 Gulf of Mexico	3/82	C D T	E H F P S_c	R N S			
RS-2 Reoffering Sale	5/82			R N S			
68 Southern California	6/82	D T	E H F	P S_c R N S			
69 Gulf of Mexico	8/82	C D T	E H F	P S_c R N S			
57 Norton Basin	9/82	T	E H	F P S_c R N S			
52 North Atlantic	10/82	D T	E H	F P S_c R N S			
70 St. George Basin	12/82	T	E	H F P S_c R N S			
71 Beaufort Sea	2/83	T	E	H F P S_c R	N S		
72 Gulf of Mexico	3/83		C D T	E H F P S_c	R N S		
61 Kodiak	4/83	C D	T	E H F P	S_c R N S		
73 California	5/83	C	D T	E H F P	S_c R N S		
RS-3 Reoffering Sale	6/83				R N S		
74 Gulf of Mexico	9/83		C D T	E H F	P S_c R N S		
75 No. Aleutian Shelf	10/83	C D T		E H	F P S_c R N S		
76 Mid-Atlantic	11/83		C D T	E H	F P S_c R N S		
78 So. Atlantic	1/84		C D T	E	H F P S_c R N	S	
79 Gulf of Mexico	3/84			C D T	E H F P S_c	R N S	
RS-4 Reoffering Sale	4/84					R N S	
80 California	6/84		C D	T	E H F	P S_c R N S	
81 Gulf of Mexico	7/84			C D T	E H F	P S_c R N S	
82 North Atlantic	10/84			C D T	E H	F P S_c R N S	
83 Navarin Basin	12/84		C D	T	E	H F P S_c R N S	
84 Gulf of Mexico	1/85			C	D T	E H F P S_c R N	S
☆ 85 Chukchi Sea	2/85		C D	T	E	H F P S_c R	N S
RS-5 Reoffering Sale	5/85						R N S
86 Hope Basin	5/85		C D	T		E H F P	S_c R N S

C - Call For Nominations
D - Nominations Due
T - Tentative Tract Selection
E - Draft Environmental Statement
H - Public Hearing
F - Final Environmental Statement
P - Proposed Notice of Sale
S_c - State Comments Due
R - Energy Review
N - Notice of Sale
S - Sale

☆ The holding of the Chukchi Sale at this time is contingent upon a reasonable assumption that technology will be available for exploration and development of the tracts included in the sale.

Figure I-2. Proposed Schedule

2. Regulatory Framework

a. OCS Lands Act Amendments of 1978

The OCS Lands Act Amendments, Public Law 95-372, approved September 18, 1978, were enacted with respect to managing the resources of the OCS. The purposes of this Act are to:

(1) establish policies and procedures for managing the oil and natural gas resources of the OCS which are intended to result in expedited exploration and development of the OCS in order to achieve national economic and energy policy goals, assure national security, reduce dependence on foreign sources, and maintain a favorable balance of payments in world trade;

(2) preserve, protect, and develop oil and natural gas resources in the OCS in a manner which is consistent with the need (a) to make such resources available to meet the nation's energy needs as rapidly as possible, (b) to balance orderly energy resource development with protection of the human, marine, and coastal environments, (c) to insure the public a fair and equitable return on the resources of the OCS, and (d) to preserve and maintain free enterprise competition;

(3) encourage development of new and improved technology for energy resource production which will eliminate or minimize risk of damage to the human, marine, and coastal environments;

(4) provide states, and through states, local governments, which are impacted by OCS oil and gas exploration, development, and production with comprehensive assistance in order to anticipate and plan for such impact, and thereby to assure adequate protection of the human environment;

(5) assure that states, and through states, local governments, have timely access to information regarding activities on the OCS, and opportunity to review and comment on decisions relating to such activities, in order to anticipate, ameliorate, and plan for the impacts of such activities;

(6) assure that states, and through states, local governments, which are directly affected by exploration, development, and production of oil and natural gas, are provided an opportunity to participate in policy and planning decisions relating to management of the resources of the OCS;

(7) minimize or eliminate conflicts between the exploration, development, and production of oil and natural gas, and the recovery of other resources such as fish and shellfish;

(8) establish an oil spill liability fund to pay for the prompt removal of any oil spilled or discharged as a result of activities on the OCS and for any damages to public or private interests caused by such spills or discharges;

(9) insure that the extent of oil and natural gas resources of the OCS is assessed at the earliest practicable time; and,

(10) establish a Fishermen's Contingency Fund to pay for damages to commercial fishing vessels and gear due to OCS activities.

Pertinent regulations under the Amendments are those issued by BLM as to leasing operations and to pipelines, and those of GS as to exploration, development and production operations. BLM regulations were published in the Federal Register of June 29, 1979 (44 FR 38268) effective July 30, 1979. GS regulations were published in final form on October 26, 1979 (44 FR 61886), effective December 13, 1979. 43 CFR 3320.2(d) provides that pursuant to Section 5(a) of the OCSLA, as amended, the Secretary may cancel a lease when:

(1) continued activity pursuant to such lease would probably cause serious harm or damage to life, property, any mineral, national security or defense, or to the marine, coastal or human environment;

(2) the threat of harm or damage will not disappear or decrease to an acceptable extent within a reasonable period of time; and,

(3) the advantages of cancellation outweigh the advantages of continuing such lease or permit in force.

b. Authorities of Other Federal Agencies

Besides BLM, other federal agencies are involved in the regulatory process of OCS oil and gas operations.

The Corps of Engineers has permitting responsibility for any structure or any other work done in, or affecting, U.S. navigable water, as well as construction of artificial islands, fixed structures, and other installations on the OCS. The Coast Guard requires permits to insure that these activities are properly marked and have lighted aids to navigation.

The Port and Waterways Safety Act (33 U.S.C. 1221), as enlarged by the Port and Tanker Safety Act of 1978, gave the Coast Guard new authority to establish "port access routes" in U.S. coastal waters. Regulations for a specific designated port access route may prohibit or restrict placement of drilling or production platforms within or adjacent to vessel traffic lanes. Before a port access route can be designated, the Coast Guard must study the need for such routes. The area of the proposed lease sale will be studied under the Port Access Route Study (PARS) and the Coast Guard will keep BLM informed of developments. In addition, they regulate offshore structures and artificial islands with respect to safety, as well as vessels involved in OCS operations.

A Memorandum of Understanding (MOU) regarding pipeline safety regulations was signed in May 1976 between the Secretary of the Interior and the Secretary of Transportation. This MOU specified each agency's responsibility as well as their joint responsibility for inspection, enforcement and coordination. Pipeline safety is ultimately regulated by the Materials Transportation Bureau within the Department of Transportation.

The Department of Energy (DOE), among its responsibilities, regulates the use of pipelines on the OCS and sets the wellhead price of OCS-produced gas, and establishes production rates for all federal leases as well as variable bidding systems to foster competition.

USGS OCS Order No. 7 stipulates that operations on the OCS must comply with the requirements of the Federal Water Pollution Control Act Amendments of 1972, which establishes a National Pollution Discharge Elimination System (NPDES) (40 CFR 125) administered by Environmental Protection Agency (EPA). At the present time, EPA has not issued any NPDES permits for oil and gas operations in the Atlantic even though all operators are required to apply for a permit prior to drilling. It is understood that EPA will not take any action against operators discharging into the Atlantic so long as the appropriate discharge permit application has been filed. In accordance with the same Act, as amended by the Clean Water Act, the U.S. Coast Guard approves the procedures and equipment for the transfer of oil from vessel to vessel and between onshore and offshore facilities and vessels and conducts pollution surveillance patrols to detect oil discharges within territorial and contiguous waters. GS performs surveillance for oil spills and discharges along pipeline routes.

The Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 et seq.) establishes a national policy designed to protect and conserve marine mammals and their habitats. The Marine Mammal Commission is responsible for reviewing and advising federal agencies on the protection and conservation of marine mammals. The Commission has a Committee of Scientific Advisors which provides advice on actions needed to fulfill the purposes of the Act. Authority for administering the Act has been delegated to both the Department of Commerce, National Marine Fisheries Service (NMFS), which is responsible for all cetaceans and pinnipeds (except walrus) and to the Deparmtent of the Interior, Fish and Wildlife Service (FWS), which is responsible for walrus, sea otters, manatees and dugongs.

The Federal Energy Regulatory Commission (FERC), an independent agency within DOE, had conferred upon it under the Natural Gas Act the authority to issue certificates of public convenience and necessity for proposed projects involving the transportation or sale of natural gas in interstate commerce. All natural gas produced from the OCS is considered to be interstate and therefore is subject to FERC jurisdiction. The Natural Gas Act, the National Environmental Policy Act, and the OCS Lands Act Amendments of 1978 grant authority or require that the FERC investigate the environmental effects of a proposed offshore project, as well as the potential gas reserves, the need for this gas, and the availability of capital to develop this resource. Also, the FERC is primarily responsible for administering and enforcing compliance with the Natural Gas Policy Act (NGPA) of 1978 (92 Stat. 3350). As applied to OCS matters, the NGPA provides new wellhead pricing controls for certain natural gas produced from the OCS.

The Endangered Species Act of 1973 (16 U.S.C. 1531-1543), as amended, establishes a national policy designed to protect and conserve threatened and endangered species and the ecosystem upon which they depend. This Act is administered by FWS and NMFS. Section 7 of the Act, governing interagency cooperation, requires federal agencies to consult with FWS and to insure that their actions do not jeopardize the continued existence of a threatened or endangered species, and/or result in adverse modification or destruction of their critical habitat.

Military exercises and training operations are periodically conducted in the Atlantic by the U.S. Air Force, NASA and U.S. Navy. Aircraft, gunnery, missile, and submarine exercises may be conducted over areas proposed for leasing in this proposed sale.

All federal agencies involved in leasing and permitting on the OCS are required under Section 106 of the National Historic Preservation Act to ensure that federal, federally assisted, and federally licensed undertakings affecting properties included in or eligible for inclusion in the National Register of Historic Places be submitted by a federal agency to the Advisory Council on Historic Preservation for review and comment prior to the agency's approval of any such undertaking. In order to determine if properties eligible for the National Register will be affected by proposed action, E.O. 11593 requires federal agencies to locate, inventory, and nominate properties under their jurisdiction or control to the National Register.

c. OCS Orders

Regulations governing drilling and producing operations on the OCS are found in Title 30, Part 250 of the Code of Federal Regulations and are administered by the Conservation Division, GS. They are supplemented by Geological Survey OCS Orders which deal specifically with problems unique to a certain area.

OCS Orders applicable to the Atlantic and other areas were revised, effective January 1, 1980, and published in the Federal Register of December 21, 1979 (44 FR 76212) covering the following:

(1) Identification of Wells, Platforms, Structures, Mobile Drillings Units, and Subsea Objects.
(2) Drilling Operations.
(3) Plugging and Abandonment of Wells.
(4) Determination of Well Producibility.
(5) Production Safety Systems.
(7) Pollution Prevention and Control.
(8) Platforms and Structures.
(12) Public Inspection of Records.

Additional OCS Orders are now under development by USGS, including Nos. 6, 9, (10 reserved), 11, 13, and 14. Copies of the revised Orders, and maps indicating the jurisdictional boundaries, are available from the Conservation Manager, Eastern Region, U.S. Geological Survey, 1725 K Street N.W., Washington, D.C. 20006.

E. Interrelationship with Other Programs and Post-sale Activity Coordination

1. Sale 43 Activities

As a result of Sale 43, eight Plans of Exploration (POE) for 11 blocks were submitted to the USGS, but only 6 exploratory wells have been drilled in the South Atlantic area. Of these 6 wells, Tenneco drilled two, Exxon drilled two, and Getty and Transco drilled one each. All were dry holes and were plugged and abandoned. Indications are that no other wells will be drilled on Sale 43 tracts, although 43 leases are still active.

No oil has been spilled during oil and gas exploration operations off Georgia and Florida, and environmental damage has apparently been minimal.

Archeology surveys were conducted on each tract prior to any activity and no indications of cultural resources were encountered. Thus, all indications are that no adverse impact to cultural resources has resulted from activities generated by Sale 43.

Biological surveys were conducted in accordance with the biological stipulation (which is essentially identical to the stipulation which will be appended to all leases resulting from this proposal; see Section I.C.2.b.) on all 11 blocks covered by the 8 POE's. Of the 6 wells actually drilled, only one was near enough to an identified live bottom to require the lessee to take any extraordinary measures; in this case the USGS Supervisor, after consultation with USFWS, BLM, and the affected states, required a monitoring program to be conducted by the lessee to determine what, if any, adverse impacts occurred to two small live bottom areas about 1,500 m from the well site. At the time of this writing, the final results are not available but preliminary indications are that no major impact occurred to this area.

During the exploration activities resulting from Sale 43, two rigs were utilized. Since there was a high turn-over rate, no figures are available on actual workers employed; however, some 30-40 positions per rig were open. The four companies involved hired an average of 1.2 secretaries each and the average duration of employment was about six weeks. During peak activity, six offshore workboats were operating in the area, and some local people were hired on a temporary basis to work on these vessels.

Air and water transportation activities for Sale 43 consisted of: one routine helicopter flight each day and 2-3 flights per week for crew changes, and 2-3 workboat (supplies) trips per week.

As for onshore facilities, Exxon, Getty, and Transco maintained shore bases in Brunswick, Georgia, and Tenneco had their base in Savannah. In addition to these, two mud companies operated out of shore bases in Brunswick and one in Savannah. Petroleum Helicopters, Inc. (PHI) maintained their helicopter base in Brunswick. Clean Atlantic Associates also had their base in Brunswick.

The city of Brunswick built an 800 foot dock with a $1.2 million loan from the Office of Coastal Zone Management, through the Coastal Energy Impact Program funding, specifically for oil exploration activities. Furthermore, the land adjacent to the new docks was leased to the oil and service companies.

As a result of Sale 43, the Conservation Division of U.S. Geological Survey opened a District Office on St. Simon's Island, Georgia. At the peak of activity, USGS brought in a total of nine staff members, and U.S. Fish & Wildlife Service established one position in Charleston, South Carolina, which was filled with an OCS activities leader already under employment with FWS. As activity has waned, the USGS office staff is being reduced to four.

In conclusion, the most significant impacts resulting from Sale 43 were socioeconomic, and they were minimal. Most of the impact onshore was centered around the Brunswick, Georgia, area. The largest economic impacts are the $1.2 million boat dock at Brunswick, Georgia; the four or more federal employees from USGS at Brunswick, Georgia; and the one FWS employee at Charleston, South Carolina. Less than $2 million was expended that would have been available to circulate as an economic factor in the Atlantic states. Considering that most of the equipment and manpower was transient, and most likely from the Gulf of Mexico area, Sale 43 had a greater socioeconomic impact on the Gulf of Mexico industries supporting oil and gas operations than on industrial activities in the affected coastal states of Georgia and South Carolina.

2. Coastal Zone Management

Seven of the nine largest metropolitan areas in the U.S. exist within the coastal zone, and more than 50% of the population lives within 50 miles of the coastline. This has caused a diversity of increasing multiple use pressures, such as recreation, plant sitings, community development and services, and expansion of port and marine facilities, among others. Because of the interface between coastal resources and land use conflicts, the Coastal Zone Management Act of 1972 (16 U.S.C. 1451-1464) was created as a combined federal/state land management partnership. The Act, administered by the Department of Commerce, National Oceanic and Atmospheric Administration, set major goals for the protection of natural resources and historic and cultural resources, provided for increased recreational access, management of coastal development, and coordination and streamlining of federal and state decisions affecting the coastal resources.

The Act provides grants-in-aid to states for the development and implementation of management programs to control land and water uses in the zone, with the objective of each state determining its own management plan particular to its own needs. Amendments to the Act, adopted in 1976, provide that states which are preparing a management program under Section 305 of the Act may receive supplementary grants and loans to ameliorate environmental and recreational losses within the coastal zone resulting from OCS and other energy development activities.

The CZMA has evolved as a major tool which states can use to coordinate the many federal regulatory measures, such as executive orders, programs and acts, which were enacted during the 1970's. These include the National Flood Insurance Program, Deepwater Port Act of 1974, Fishery Conservation and Management Act of 1976, and the OCSLA Amendments of 1978.

Section 307 of the Act requires that federal actions within or directly impacting the coastal zone be consistent with a state's program once that program has been approved by the Secretary of Commerce, and that state plans must consider the national interest in energy facilities sitings. Local governments, in turn, must consider state and regional interest in the exercise of their regulatory powers in the coastal zone. However, should

the state determine that a project is inconsistent with its program, the federal government retains the right to overrule that decision, if the project is considered to be of national significance. For more detailed information about federal consistency, the Office of Coastal Zone Management in Washington, D.C. has prepared a booklet titled, "Federal Consistency in a Nutshell."

Of the four states affected by this proposed sale, North Carolina (3,375 coastline miles) and South Carolina (2,876 coastline miles) have approved CZM plans. Although Georgia has withdrawn from the CZM program, it has produced a Draft Coastal Management Program, dated November 22, 1979, relative to Section 308 of the Act. The state of Florida is in the preparation and development stage for its program.

3. Estuarine and Marine Sanctuary Programs

NOAA is responsible for the National Estuarine Sanctuary and the National Marine Sanctuary Programs. These sanctuaries would provide special protection to designated unique habitats or resources in the marine environment.

The Marine Protection, Research and Sanctuaries Act of 1972 (16 U.S.C. 1431-1434) authorized the creation of estuarine sanctuaries. Although this program is administered by the Office of Coastal Zone Management (OCZM), in NOAA, any area designated as a National Estuarine Sanctuary would be owned and managed by the appropriate state which may cooperate with local government, and other public or private institutions or organizations.

Under the Marine Protection, Research and Sanctuaries Act, OCZM is responsible for administering the Marine Sanctuaries Program. Areas designated in this system are managed at the federal level.

One estuarine sanctuary has been designated in this area: Sapelo Island National Estuarine Sanctuary. Sapelo is one of Georgia's barrier islands and is protected by the state and by two federal agencies, the Office of Coastal Zone Management and the Heritage, Conservation, and Recreation Service. The 7,400-acre Duplin River/ Sapelo Island National Estuarine Sanctuary is part of this protected island ecosystem. The sanctuary serves as a natural field laboratory for studies in estuarine ecology and as an environmental education center for institutions and members of the public. The island also contains the University of Georgia's Marine Institute, the 8,240-acre R. J. Reynolds State Wildlife Refuge, and the 400-acre Hog Hammock, a black community established over 200 years ago. Adjacent to Sapelo Island is Blackbeard Island National Wildlife Refuge and Wolf Island National Wildlife Refuge.

One marine sanctuary has been designated in the area: Monitor Marine Sanctuary. Located off the coast of Cape Hatteras in 200 feet of water, this marine sanctuary is designed to protect cultural and archeological resources of this historic wreck.

Gray's Reef is currently being studied for possible inclusion in the marine sanctuary system. Gray's Reef is a naturally occurring live bottom reef located in 19.8 m (65 ft.) of water 33 km (18 nautical miles) east of Sapelo Island, Georgia. The reef encompasses approximately 40.7 square kilometers (12 square miles) of ocean floor and is recognized as a popular area for offshore recreational fishing. Gray's Reef supports numerous ichthyofaunal assemblages dominated by the families Serranidae, Lutjanidae and Sparidae. Several universities use the area in research activities pertaining to fishery resources, the origin and geology of the reef and the relationships among benthic invertebrates and fish. A nomination by the Georgia Department of Natural Resources to designate Gray's Reef as a marine sanctuary was submitted to OCZM in June, 1978. In accordance with regulations, OCZM has initiated the process of a feasibility determination of Gray's Reef for possible sanctuary status. A notice was published in the Federal Register (December 27, 1978) announcing OCZM receipt of the nomination and requesting information and comments on the feasibility of the reef as a marine sanctuary.

OCZM suggested that certain tracts near these sanctuary areas not be considered for leasing, and therefore none of the proposed tracts are within 20 nmi of these features.

4. Intergovernmental Planning Program (IPP)

The Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation and Related Facilities is being implemented to provide a formal coordination and planning mechanism for three major OCS program elements administered by BLM. These are: (1) the leasing process, (2) the Environmental Studies Program, and (3) transportation planning for OCS oil and gas. This program will apply specifically to those activities which fall within the purview of BLM and does not affect existing authorities and responsibilities.

The program established a Policy Committee, a Scientific Committee, and in each of the six leasing regions, a Regional Technical Working Group Committee. The Policy Committee advises relative to discretionary functions, including all aspects of OCS exploration and development of resources. The Regional Technical Working Group Committees provide guidance to BLM and information to other Interior bureaus through the acquisition and evaluation of information, and serves as forums for information exchange for planning activities, the development of transportation management plans, and the location of associated onshore facilities. The Scientific Committee advises relative to the feasibility, appropriateness, and scientific value of BLM's Studies Programs.

5. Land and Water Conservation Fund

Revenues derived by the U.S. government from offshore mineral development has a tremendous impact on the annual appropriations into the Land and Water Conservation Fund (L&WCF). The L&WCF is the major federally financed grants program instituted by Congress to assist the states in developing and acquiring outdoor recreation lands and facilities and has assisted them in financing comprehensive outdoor recreation planning. Likewise, the L&WCF has been instrumental in assisting federal land managing agencies in purchasing recreation and endangered species lands in national parks, forests, wildlife refuges, wild and scenic rivers, and wilderness areas throughout the country. Over $3 billion, earmarked for public recreation, have been dispersed through the Heritage Conservation and Recreation Service (HCRS) as matching grants to states and their political subdivisions and as land acquisition funds to federal land managing agencies since the Fund's inception in 1965. Over 65% of these revenues were derived from bonuses, leases, and royalties stemming from exploration and production of oil and natural gas on the federally administered outer continental shelf. A 1976 amendment to the L&WCF Act has increased the annual L&WCF authorization ceiling from $300 to $900 million, thereby indicating a continued and increasingly important relationship between offshore oil/gas development and enhancement of America's recreation estate.

Net L&WCF Apportionment Sum for South Atlantic and Other States
as of September 30, 1978 (Cumulative)

STATE	$ MILLIONS
North Carolina	42.1
South Carolina	31.6
Georgia	44.5
Florida	64.6
All Other States	2,049.7
TOTAL TO STATES	$2,232.5

6. Marine Fisheries Management

The Fishery Conservation and Management Act (FCMA) of 1976 (16 U.S.C. 1801-1882) extended the U.S. jurisdiction of fisheries out to 200 miles. The Act provided for the creation of eight Regional Fishery Management Councils. The South Atlantic Fishery Management Council has the fishery management responsibility in the area under consideration in this proposal.

The Council's function is to prepare Fishery Management Plans (FMP) needed to manage both domestic and foreign fishing within the 200 mile zone. Further, the Councils recommend regulations which are designed to produce the annual Optimum Yield for the stocks in their region. Optimum Yield is defined as the amount of fish which will provide the greatest overall benefit to the nation with particular reference to food production and recreational opportunity. FMP requires approval by the Secretary of Commerce prior to issuance of regulations to implement the Plan.

To date no FMP's have been implemented in the South Atlantic region. Several FMP's are in preparation: billfish, calico scallops, coral, king and Spanish mackerel, snapper-grouper complex, spiny lobster, and swordfish. The management options generally address regulating the level, the method, and/or the area of catch. All FMP's

must be consistent with the seven National Standards which are specified in the Act. No conflicts between this proposal and FMP's being developed by the South Atlantic Fishery Management Council have been identified at this stage.

7. Post-sale Activity Coordination

a. Exploration Activities

After the leases are issued, the U.S. Geological Survey is responsible for managing and monitoring the operations on the OCS tracts. Before a lessee may begin exploratory drilling on the lease(s), an exploration plan and an accompanying environmental report must be prepared and submitted for approval to the U.S. Geological Survey. The Bureau of Land Management and the Fish and Wildlife Service review and make recommendations to the USGS on all exploration plans. These documents provide information on the methods to be used in exploration and provide assurances of effective and environmentally sound exploration activities. In accordance with the Coastal Zone Management Act of 1972 (PL 94-370), states with an approved Coastal Zone Management (CZM) Plan concur with or object to the consistency certification submitted by industry with the Exploration Plan and the Environmental Report.

An environmental assessment is prepared by the USGS based on all available environmental information including the exploration plan, the environmental report, and state comments (including consistency certification concurrence where applicable). If the environmental assessment indicates that approval of the plan would constitute a major federal action significantly affecting the human environment, an environmental impact statement (draft and final) must be prepared. On the basis of the environmental assessment or the environmental impact statement findings and the technical review by the USGS, the exploration plan will be approved, disapproved, or modified.

After approval of the exploration plan and environmental report, the lessee may obtain a drilling permit for exploration by filing an application for permit to drill (APD). The APD is approved by the USGS after a detailed review of the application and a hazard analysis of the drill site. Other permits required prior to exploratory drilling include permits for aids to navigation from the U.S. Coast Guard, navigation permits from the U.S. Army Corps of Engineers, and National Pollutant Discharge Elimination System (NPDES permits from the U.S. Environmental Protection Agency.

b. Development and Production Activities

Prior to development and production, the lessee must prepare a development and production plan and an accompanying environmental report. The plan, submitted to the USGS for approval, and reviewed by the BLM and FWS describes all development and production activities planned by the lessee for a specific lease(s), and the timing of these activities. The environmental report analyzes the impacts that may occur as a result of implementation of the plan. The report considers both offshore and onshore impacts. The development and production plan and the environmental report are sent to all of the potentially affected states for comments, and to states with an approved CZM plan for consistency certification concurrence.

After receiving the development and production plan and the environmental report, the USGS prepares an environmental assessment. If the assessment indicates that approval of the plan is a major federal action significantly affecting the quality of human environment, a draft environmental impact statement is prepared followed by a public hearing and a final environmental impact statement, prior to the plan's approval (or disapproval).

If the development and production plan is approved, industry submits an application for permit to drill to the USGS for approval. There is no "drilling permit" per se, rather an approved "application for permit to drill" constitutes the permit. Additional applications submitted for approval to various federal agencies include those to install platforms, permits for aids to navigation from the U.S. Coast Guard, navigation permits from the U.S. Army Corps of Engineers, and NPDES permits from the U.S. Environmental Protection Agency. Once the application for permit to drill has been approved, industry activity may begin.

With the approval of the USGS, the individual lessees determine the amount and duration of production. However, once production begins, certain federal regulatory requirements must be met, including: monthly

reports of production; lessee compliance with all safety and operating requirements of the USGS and Coast Guard; and obtaining USGS approval of any significant modification of production equipment or procedures.

For various reasons, lease termination proceedings may be initiated by the Department of the Interior or by the lessee. In this case, or when a lease expires, all well heads (for exploration, development, and production) must be cut off below the surface of the ocean floor and other bottom obstructions must be removed. The BLM is responsible for all official record title actions.

c. Pipelines: Rights-of-Way and Rights-of-Use and Easement

Once oil and gas is found, a grant of right-of-way (BLM) or a grant of right-of-use or easement (USGS) may be required for pipeline transportation across the OCS. These applications are reviewed by a number of agencies, depending on the purpose of the pipeline, the mineral resource being transported, and the onshore facilities required. The Department of Transportation's Materials Transportation Bureau is responsible for issuing regulations for pipelines on the OCS, while the USGS performs a technical review and makes a hazard analysis of the proposed pipeline route. In addition, the U.S. Army Corps of Engineers issues permits for the construction of pipelines in navigable waters, the FWS reviews all pipeline applications, and state and local agencies are responsible for regulation of pipelines in state waters.

II

Section II

Alternatives Including The Proposed Action

II. ALTERNATIVES INCLUDING THE PROPOSED ACTION

There are three major alternatives to holding this proposed oil/gas lease sale. They are: Modify the Sale (by three modifications), Delay the Sale, and Withdraw the Sale. Each of these options will be compared to the alternative of holding the sale as proposed.

A. Alternative A - Hold the Sale as Proposed

1. Description

The area under consideration for this proposed U.S. South Atlantic OCS sale is described in Section I.C.1.

Holding the sale as proposed will result in the expected production of 1.4 billion barrels of oil and 2.5 trillion cubic feet of gas (mean estimate). This is judged to be a gain to the nation from both the standpoint of energy needs and the economic and political goal of independence from energy imports.

Sections IV.A. and B. describe the resource and offshore infrastructure estimates and the development assumptions and scenarios for the proposal.

2. Summary of Environmental Consequences

a. Impact on Air Quality

Potential sources of emissions which might significantly affect air quality in the sale area include offshore platforms (routine operations and blowouts), onshore facilities (terminal/storage facilities and gas processing plants), and onshore population growth resulting from sale-related development (see Section IV.D.1.a.).

Emissions produced during routine offshore operations include exhaust gases from internal combustion engines and venting or flaring of produced waste gas. Exhaust gases will be produced in greatest volumes during drilling operations, generally the first year or two of platform operations. Exhaust gases will include nitrogen oxides (NO_x), sulfur oxides (SO_x), hydrocarbons (HC), carbon monoxide (CO), and particulates. Quantities produced will vary with intensity of drilling operations, then will decline as the wells are completed and put into production. Estimates of quantities produced during drilling are included in Section IV.D.1.a. These emissions may degrade air quality locally in the immediate vicinity of the platforms, but will disperse to undetectable quantities within a few miles.

Vented gas is primarily methane. If combusted (flared), there is a 99.5% reduction in hydrocarbons, resulting in emissions primarily of carbon dioxide and water, with minor amounts of carbon monoxide, sulfur oxides, and aldehydes. Volumes vented or flared will depend on volumes produced. These emissions will also affect air quality only in the vicinity of the producing platform.

A gas blowout would also result in losses of gas to the atmosphere; this gas would be primarily methane. If accompanied by a fire, the gas would be combusted to mostly carbon dioxide and water vapor, to negligible amounts of nitrogen oxides and particulates, and to measurable amounts of sulfur oxides, hydrocarbons, and carbon monoxide. These substances would degrade air quality in the proximity of the blowout site for the duration of the blowout, but would disperse to undetectable levels within a few miles. Most blowouts are of short duration, measured in hours or days. As many as 6 blowouts may be expected to occur during the 30 year life of the field.

Onshore terminal/storage facilities will contribute minor amounts of hydrocarbons through evaporative loss. No significant impact is expected as a result of these emissions. Gas processing plants may contribute minor amounts of sulfur oxides to the atmosphere. The amounts of SO_x emitted will vary with quantities of gas processed, sulfur content of the gas, and nature of the processes used. In general, the South Atlantic regions has air quality problems in only a few urban areas. If these plants were constructed in those urban areas, mitigating measures might be necessary to comply with federal or state air quality standards.

Induced population growth may result in population increases of a few thousand individuals in the region. If all growth was to occur in a single urban area, impact on air quality caused by automobile exhaust emissions would cause significant air quality degradation. More likely, population growth will be dispersed throughout the region or at least in more than one urban center, and air quality additions will not be significant.

Conclusion of Impact on Air Quality

It is not anticipated that air emissions from major sources resulting from Sale 56 will exceed federal or state air quality standards or that they will have more than a local impact on air quality. Only onshore, in the vicinity of processing facilities will duration of emissions continue over the life of the field. Offshore impact will be localized in the vicinity of the production platforms. Onshore emissions and offshore emissions impacting onshore air quality will be regulated according to existing federal, state, and local regulations.

Cumulative Impact on Air Quality

Present experience indicates no significant onshore population growth and no present development of onshore terminal/storage or processing facilities as a result of Sale 43. Should finds on the order of the Sale 43 high resource estimate be made on Sale 43 tracts, one gas processing plant might be constructed and perhaps a few thousand new residents might immigrate into the area. Even these additional onshore emissions sources would not be expected to cause insurmountable air quality problems, although mitigating measures might be necessary if all growth was to occur in an urban area with present air quality problems. The overall conclusion is that the cumulative air quality impacts that might result from these two sales will not be a major contributor to air quality degradation, either offshore or onshore.

b. Impact on the West Indian Manatee

The FWS biological opinion pertaining to proposed Sale 56 indicates that oil/gas leasing and exploration activities resulting from this proposal are not likely to jeopardize the endangered species considered in the Section 7 consultation, or result in the destruction or adverse modification of their critical habitats (see Section IV.D.1.b., Appendix B, and visual 3). However, there is a potential for West Indian manatee mortality from increased vessel traffic in the Brunswick/Savannah/Jacksonville harbors. Manatees migrate into these harbor areas during the summer season and could be injured or killed by collisions with these vessels.

Conclusion of Impact on the West Indian Manatee

As a result of this proposal (Alternative A), offshore service vessels will be making about 1-3 trips/week from Brunswick/Savannah/Jacksonville harbor areas. This vessel traffic poses an undetermined threat to manatee populations in these areas.

Cumulative Impact on the West Indian Manatee

No vessel collisions with manatees have been reported as a result of Sale 43 activities and none are expected because no additional exploration activities are planned for the 43 leases.

c. Impact on Commercial Fisheries

Section IV.D.1.c. discusses in detail the potential impacts to fisheries resources which may result from this proposal. The conclusion reached was that such impacts will be minor and insignificant.

Section III.C.5. discusses fisheries on the South Atlantic OCS. Section I.C.3.f. discusses the Fishermen's Contingency Fund which would serve to mitigate economic losses to fishermen resulting from trawl snag or the like on structures which may result from this proposal. Appendix D discusses oil spill risks and shows that there is a very small probability of an oil spill reaching the coastal inlets which are so important to fisheries resources. Although three oil spills are likely to take place as a result of this proposal (assuming there is any production at all), the impact on fisheries from any such spills is believed to be very small. Losses due to space-use conflicts will probably be the most persistent loss occurring as a result of this proposal. Conflicts may occur between towed gear, trawls, and oil and gas structures. The placement of structures and pipelines will reduce the amount of potentially trawlable seafloor; however, the percentage is nearly infinitesimal. Offshore structures increase the

available recreational fishing area for the reef fishes. The alignment of structures may interfere with purse-seining operations, but skilled fishermen should be able to avoid entanglement.

Reef fishes often congregate near live bottom and reefal areas, using them as a habitat. Section IV.D.1.d. notes that there will be little impact on these areas resulting from this proposal.

Conclusion of Impact on Commercial Fisheries

In view of the above, it is concluded that holding the sale as proposed or adoption of any of the alternatives will have no significant impact on fisheries resources.

Cumulative Impact on Commercial Fisheries

Operations conducted as a result of Sale 43 had no apparent impact on fisheries. Since there will be no significant impact resulting from this proposal, there will also be no significant cumulative impact to this resource.

d. Impact on Live Bottoms and Reefs

Section IV.D.1.d. discusses in detail the potential impacts to live bottom and reefal areas which may result from this proposal. The conclusion reached was that such impacts are considered to be negligible since the stipulation described in Section I.C.2.b. will be imposed on any lease resulting from the sale.

In Section III.B. it is noted that live bottom areas are not well mapped. Since oil/gas activities, such as platform and pipeline emplacement and muds and cuttings discharge, may have the potential to harm the biota of such areas, the biological stipulation requires the lessee to map such areas and then the lessee is either required to remain well clear of the live bottom area or to modify the operation in such a way as to prevent harm to the biota. Staying clear of these areas will prevent mechanical damage from anchors, pipelines, and the rig itself, and will provide for adequate dilution and dispersion of muds and cuttings so that the biota of the live bottoms should not be adversely affected. In general, such activities will be prohibited within 1 nmi of the live bottom unless there is some further operational restriction applied.

Oil spills will have no impact on live bottom and reefal areas unless the depth of water is shallow enough to allow the oil to contact the biota; if such contact should occur, the effects on the biota are unknown. For the Onslow Bay live bottom area and Gray's Reef, the oil spill analysis (Appendix D) indicates a very low probability that oil spills will reach these area; the expected number of spill reaching Onslow Bay is 0.2-0.4, and the expected number reaching Gray's Reef is 0.0-0.1. To have any impact, the oil would then have to be mixed with the water to the extent that it comes in contact with the biota; the likelihood of all this occurring is very little indeed.

Conclusion of Impact on Live Bottoms and Reefs

In view of the above, it is concluded that holding the sale as proposed or adoption of any of the alternatives will have no significant impact on live bottom or reefal areas.

Cumulative Impact on Live Bottoms and Reefs

Operations conducted as a result of Sale 43 had no apparent impact on live bottoms or reefs. Since there will be no significant impact resulting from this proposal, there will also be no significant cumulative impact to these areas.

e. Impact on Community Services and Facilities

Increased demand for, and consumption of community services and facilities related to OCS-generated population is expected to be met without significantly lowering existing service levels and standards (see Section IV.D.1.e.). At worse, these increased demands could contribute to a minor short-term (1-3 years) impact on the

quality of a public service in a particular local jurisdiction (the smaller communities would be more likely to experience this type of impact).

The direct requirements of OCS development activities are not expected to create significant local problems in the onshore development areas.

Revenues generated by OCS direct and induced activities are expected to be sufficient over the long-run to cover expenditures. However, some fiscal balance problems could arise because of the lag between the time that service needs arise and the time at which traditional revenue sources imposed on the new development and activity begin to produce corresponding revenue. There may also be imbalances between the communities in which the OCS-generated industrial facilities are located and the communities in which the new residents reside.

Conclusion of Impact on Community Services and Facilities

It is expected that potentiallly significant adverse impacts related to the provision (and financing) of community services and facilities will be avoided entirely or substantially reduced through effective management planning by state and local governments. In this regard, the Coastal Energy Impact Program (CEIP), in which state and local governments receive financial assistance for planning and dealing with the fiscal impacts of OCS-related development, is expected to be an important mitigating factor.

Cumulative Impact on Community Services and Facilities

OCS Sale 43 exploratory drilling which occurred in 1979 had a minimal impact on the communities in which onshore support bases were located. On the basis of the poor results of the exploratory activity which took place in 1978, current indications are that any further exploratory effort will be minimal. Thus, the cumulative impact of proposed OCS Sale 56 would be essentially the same as postulated and analyzed in this document.

f. Impact on Recreational Fishing

Section IV.D.1.f. discusses in detail the potential impacts on recreational fishing which may result from this proposal.

Conclusion of Impact on Recreational Fishing

This proposal should enhance recreational fishing potential offshore by creating artificial reefs which will concentrate sports fishing targets in the Atlantic Ocean within leased tracts which are ultimately developed (56 potential structures), especially those within 30 miles of shore (1 structure). Although short term adverse impacts from marine pollution events (3 oil spills and drill hole effluent discharges) and habitat modification associated with drilling up to 1,400 wells, installing up to 56 structures and 540 miles of pipeline may temporarily affect some fishing activity, the potential for sustained (up to 30 years) positive impacts (recreational fishing success) are far greater.

Cumulative Impact on Recreational Fishing

Should commercial finds from Sales 43 and 56 combined lead to additional oil and gas interest and development in the South Atlantic area, a new recreational fishery could be developed in 8-10 years.

g. Impact on Shoreline Recreation

Section IV.D.1.g. discusses in detail the potential impacts on shoreline recreation which may result from this proposal.

Conclusion of Impact on Shoreline Recreation

There is some risk that shoreline recreational areas and activities will be adversely affected by this proposal. Most of the impact which does occur is not expected to affect the level of recreation use, but may affect the quality of recreational experiences. For example, a person recreating on the shorefront may encounter minor pollution such as trash or a tarball, noise, or more competition for space as a result of this proposal, but is unlikely to change his recreational habits. Such impact would be associated with or result from pipeline landfalls, transit to and from offshore lease tracts, indiscriminate disposal of persistant flotable trash into the marine environment, dramatic population increases in concentrated areas (Morehead City and Brunswick), oil pollution from offshore lease tracts, and possible transportation corridor developments. There is a 50% chance that at least one major oil spill will cause a pollution incident sufficient to warrant closure of a shorefront recreational area(s) leading to temporary displacement of recreation use, especially along the North Carolina outer banks.

Cumulative Impact on Shoreline Recreation

Even though proposed Sale 56 doubles the risk of a major spill incident occurring offshore of the South Atlantic states, there is only a small incremental risk that shoreline recreational resources will be appreciably affected.

h. Impact on Tourism

Section IV.D.1.h. discusses in detail the potential impacts on tourism which may result from this proposal.

Conclusion of Impact on Tourism

This proposal is expected to cause 3 major oil spills which could threaten the integrity of a tourist destination area (beach) and lead to a temporary (up to one season) demise in the tourist economy of the U.S. South Atlantic seaboard in the next 2-30 years. There is a 50% chance that at least one oil pollution event will physically damage tourist beaches in Georgia or North Carolina. Such an incident, should it occur, is most likely to be associated with transportation of crude oil discovered. This impact should be localized and short term with only mild economic consequences, but could become regional in scope and more economically significant depending on beaching location, spill size, season of the year, and publicity associated with a major pollution incident.

Cumulative Impact on Tourism

Although Sale 56 will increase the risk that an economically damaging oil spill incident will affect some South Atlantic shorefront tourist community, some risk already exists and will continue from tankering activities. Tankering of crude oil is not likely to increase in the foreseeable future, but large finds of crude oil off the east coast could ultimately reduce foreign tankering which is currently a greater threat to the South Atlantic shorefront tourism economy than is offshore crude oil development on the U.S. outer continental shelf.

i. Impact on Water Quality

The major impacts to water quality which may result from the proposed sale will be due to routine offshore platform operations, onshore operations and facilities, onshore population growth, and occasional oil spills (see Section IV.D.1.i.).

Routine offshore platform operations will include discharges of muds, cuttings, deck drainage, sanitary treatment effleunts, and produced formation waters. Discharges of muds may produce plumes which extend for hundreds of meters. Physical impact from mud discharges is expected to be confined to 1 km or less from the discharge site, however. Toxic effects are expected to extend no more than a few meters from the discharge site. Discharges of cuttings are expected to cause some physical alteration of benthic habitat, but no toxic effects.

Cuttings piles generally disappear as a result of physical and biological processes within a few months following cessation of drilling. Discharges of water from deck drainage and other miscellaneous sources, sanitary effluents, and produced formation waters are expected to cause water quality degradation only within a few meters of the discharge site. EPA regulations prohibit discharge of waters, including deck drainage or formation waters, containing more than 30 mg/l oil or grease. The target chlorine residual for sanitary treatment effluents is 1 mg/l. All of these discharges will mix to undetectable levels within a few to ten or so meters of discharge.

Pipeline emplacement activities may cause significant amounts of sediments to be resuspended during jetting of the trench. If much mud or clay is present, a suspended sediment plume may be generated. This plume may extend for several hundred meters and may cause some water quality degradation, but this will be a short-lived phenomenon restricted to the vicinity of the pipeline route.

Oil spills resulting from offshore platform operations or accidents, pipeline operations or accidents, or tankering operations or accidents pose the most severe threat of water quality degradation. As many as 6 oil spills are predicted by the oil spill risk analysis model as a result of Sales 43 and 56 and existing transportation. As many as three, but more likely two spills are predicted as a result of Sale 56. Impact from oil spills offshore will be negligible, but nearshore and onshore impact may be severe if the oil reaches beaches, estuaries, or wetlands. Impact from spills is generally a short-term problem, however, with recovery occurring in a matter of a few weeks to a few years, depending on magnitude of the spill and effectiveness of cleanup/containment activities.

Conclusion of Impact on Water Quality

The only significant impacts projected for the onshore environment as a result of South Atlantic OCS activities, considering impacts of operations bases, terminal/storage facilities, gas processing plants, and existing refineries, and induced population growth is a minor increase in municipal sewage loading. Onshore water quality impacts will be mitigated by existing regulations administered by State Water Quality Boards under EPA guidelines.

Cumulative Impact on Water Quality

No cumulative impacts on water quality are expected to result from this proposal.

B. Alternative B - Modify the Proposal Via Potential Tract Deletions

The tentative lease tracts for proposed Sale 56 (Alternative A - Hold the Sale as Proposed) are subject to potential deletion at the request of federal, state, and local government agencies, organizations, companies, and individuals for several reasons (see Sections I.B. and V.). Three potential deletion modifications comprise Alternative B and deal with:

1) Fisheries Resources (B-1)
2) Deepwater Tracts (B-2)
3) Nearshore Tracts (B-3)

For a comparison of the impacts for each modification to Alternative A, see table S-1 in the Summary which lists impacts relative to the specific areas of concern. For a comparison of the resource and development estimates for each modification to Alternative A, see table IV-13 in Section IV.D.1. In general, deletion of certain tracts from the proposed sale would reduce the risk of potential environmental impacts; however, it would also reduce the potential oil/gas production by the estimated percentage indicated for each modification.

1. Modification B-1: Potential Deletion of 42 Tracts to Protect Fisheries Resources

a. Description

Forty-two tracts have been identified through the scoping process as possible deletions from this proposed sale in order to protect fisheries resources. These tracts are:

Tracts 1-5 — Currituck Sound - Blocks 777, 821, 865, 909, and 953. These are located in water depths ranging from 1,000 m to 1,350 m (3,281-4,455 feet).

Tracts 6-27 — Manteo - Blocks 246, 247, 290, 291, 334, 335, 378, 379, 422, 423, 466, 467, 510, 511, 553, 554, 555, 597, 598, 640, 641, and 62. Water depths in this area are from 200-2,100 m (656-6,889 feet).

Tracts 28-39 — Russell - Blocks 709, 710, 751, 752, 753, 754, 794, 795, 796, 837, 838, and 839. Water depths in this area ranges from 400-1,800 m (1,312-5,905 feet).

Tracts 152, 156, and 160 — James Island - Blocks 841, 885, and 929. Water depths for these blocks are 29-31 m (95-102 feet).

Tracts 1-39 were suggested for deletion because these areas may provide habitat for deep snappers and groupers, the American lobster, and red crabs. Snappers and groupers are found at the very narrow band of shelf-break reefs; however, as discussed in Section IV.D.1.c.(1)., the impact from this proposal on these resources is expected to be very small. Furthermore, most of the tracts under consideration here are deeper than the snapper/grouper resource is known to occur. The lobsters and red crabs occur in deeper waters than do the aforementioned reef fish, but little is known of specific locations.

Tracts 152, 156, and 160 were suggested for deletion because of their proximity to calico scallop grounds. These scallops are apparently very mobile and scallop grounds are ephemeral. Little is known of their movements from year to year.

b. Summary of Environmental Consequences

Should this deletion option be adopted:

(1) A insignificant reduction in employment and related benefits to the states of North Carolina and South Carolina would occur;

(2) A slight effect on the potential for development of the community and oil/gas infrastructure would be precluded;

(3) Air and water quality effects in the vicinity of these tracts would be precluded;

(4) Preclusion of any environmental effects which would have resulted from oil and gas development; and

(5) The potential for environmental damage due to oil spills would be precluded in the vicinity of these tracts, and the overall reduction of oil spills in Alternative A would be reduced by 15%.

2. Modification B-2: Potential Deletion of 130 Tracts with Water Depths Greater than 400 Meters

a. Description

Those tracts which occur in deeper than 400 meters of water and which would be deleted under Alternative B-2 are: Currituck Sound 1-5; Manteo 7, 9, 11, 13, and 15-27; Russell 28-33, 35, 36, 38, and 39; Cape Fear 46-130; and Stetson Mesa 162-174. All tracts which lie in water depths deeper than 200 m (137 total) received negative nominations from NRDC and from Georgia Conservancy. It should be noted here that USGS considers operations in depths up to 400 m to be routine and not requiring special consideration in tract selection.

Water depths in the tracts considered under this modification range from 400 to 2,100 m. The tracts represent about 45% of the sale and their deletion, according to BLM estimates, would result in the potential loss of from 0.36-0.95 billion barrels of oil and from 0.63-1.57 trillion cubic feet of natural gas. This deletion could also result in between 207-630 wells not being drilled.

Present oil industry technology is capable of drilling exploratory wells in water depths of 1,800-2,500 m of water, although uncertain economic potential has limited the industry to 1,486 m in water depth. Technology now exists for installing subsea wells and associated facilities in water depths of about 1,200 m, and existing equipment can lay pipelines in up to about 1,000 m of water.

Many of the aforementioned deepwater tracts are situated under the Gulf Stream, and concern has been expressed that such currents may prevent drilling, or possibly cause accidents. The drillship "Sedco 472" drilled

an exploratory well for Esso Exploration in 1,200 m of water off the coast of Surinam in the South Equatorial Current where currents of the same magnitude as the Gulf Stream were encountered, i.e., 3 knots. The opportunity to drill this site provided the incentive for Sedco and Esso to design some special equipment and procedures which enabled them to successfully drill the well. Although each location presents special requirements which have to be met, flexibility and proper technical preplanning will usually provide the equipment and procedures to successfully complete deepwater wells.

A logical assessment would be that much of the "easy" oil and gas has already been found and, as the demand continues in the future, the search must necessarily move to areas that have not been previously explored, such as deep water. In order to develop the technology necessary to exploit deep water hydrocarbon resources for the future, the incentives must be presented on a timely basis now.

For a more detailed discussion of deep water technology, see Appendix I.

b. Summary of Environmental Consequences

Should this deletion option be adopted:

(1) A significant reduction in employment and related benefits to the state of North Carolina, and to a lesser extent South Carolina and Georgia, would occur;

(2) A significant effect on the potential for development of the community and the oil and gas industry infrastructure would be precluded;

(3) Air and water quality effects in the vicinity of those tracts deleted would be precluded;

(4) Preclusion of any environmental effects which would have resulted from oil and gas development; and

(5) The potential for environmental damage due to oil spills would be precluded in the vicinity of those tracts, and the overall reduction of oil spills in Alternative "A" would be reduced by 45%.

3. Modification B-3: Potential Deletion of 6 Tracts Within 30 Nautical Miles of Shore

a. Description

The 6 tracts (Beaufort 40-45) lie in a 54 square mile area from 16-23 nautical miles due east of Cape Lookout, North Carolina, in water depths of 20-26 meters (see visual 1). These tracts form a consolidated rectangular grouping closer to the South Atlantic shoreline (Cape Lookout National Seashore) than any other tract(s) offered for leasing on the OCS to date. They contain 2.1% of the acreage proposed for offer, so consequently they could plausibly contain approximately 2% of the oil and gas resources estimated for the proposed alternative. It is estimated that 9-18 wells may be drilled in these 6 tracts and should a commercial discovery be made, one production platform would be required. If production warrants the development of a pipeline, it is most likely to connect with a central gathering line farther offshore.

This deletion option alternative was developed in response to environmental issues expressed by the National Park Service, the Natural Resources Defense Council, Inc., and the National Oceanic and Atmospheric Administration. Specific concerns relate to the integrity of shoreline natural and recreational resources and the aesthetic affect of leasing these nearshore tracts on visitor use of the outer banks, especially Cape Hatteras and Cape Lookout National Seashores. Also of concern is the effect leasing of these 6 tracts would have on shipwrecks reported to be in tracts 41, 42, and 45, and a hard bottom community reported in tract 43.

b. Summary of Environmental Consequences

Should this deletion option be adopted:

(1) The only possible lease site activity associated with the proposal that would be potentially visible from limited shore bases during ideal atmospheric conditions would be eliminated from the sale;

(2) The lease tract grouping posing the greatest relative threat (25% chance of impact from a 30 day spill) to the beaches of North Carolina's outer banks area and Cape Hatteras and Cape Lookout National Seashores would be eliminated;

(3) The potential development of one high profile artificial reef accessible to most of North Carolina's offshore boat fishermen would be eliminated;

(4) The possible exploration and development of oil and gas on 54 square miles of the South Atlantic OCS would be eliminated from the sale causing the loss or delay in development of an estimated 0.01-0.04 billion barrels of oil and 1.4-3.5 trillion cubic feet of gas (2% of the sale) from our national energy supplies.

(5) The potential hard bottom reported in tract 44 or any others in these 6 tracts would be unaffected by this sale; and,

(6) Any reported or unreported shipwrecks of historical or biological value (artificial reefs) in the vicinity of these 6 tracts would be unaffected by this sale.

C. Alternative C - Delay the Sale

1. Description

Delay the Sale is addressed as an alternative because it has occurred in past OCS lease sales in other areas. While there are no specific issues in the South Atlantic area known at this time which may cause a delay, it is possible that the sale could be delayed for reasons which may occur before the sale is finalized.

In delaying a sale, tracts could be withheld for an indefinite period of time. Historically, no extension date has been given and the time assumed for this sale is between 1 and 2 years.

2. Summary of Environmental Consequences

There are both positive and negative impacts associated with this alternative. On the positive side, impacts discussed for Alternative A would be delayed; however, once the sale is reinstated those same impacts would likewise apply.

This delay period would allow additional time for completion and/or development of continued data gathering based on studies currently being conducted or in the planning stages, some of which include a wetland and an ecological inventory of the South Atlantic area (see visual 8 for more details of studies). During this same timeframe, new studies information may become available which could enhance greater resource recovery technology and could provide more domestic energy production.

Since there is not a highly developed infrastructure of onshore oil and gas facilities in the South Atlantic area, extended lead time would allow state and local planners additional time to further coordinate their efforts with the appropriate contacts in order to mitigate or alleviate stresses and concerns which may occur in the coastal zone as a result of OCS activities.

On the negative side, the economics of the industry and the importation of oil will be impacted. Industry activities parallel the Department of the Interior's 5-Year Oil and Gas Leasing Schedule which is used as a timeframe for planning investments and exploration and development projects. Likewise, many smaller ancillary businesses are correlatively subcontracted by the oil companies. A delay of 1-2 years could impact the smaller industries to a greater extent than the larger ones, since their viability revolves around actual operations. Also, investments made by the industries in developing pre-leasing tract information upon which bidding decisions are made are held in abeyance until the sale is reinstituted.

Any employment which would have resulted from this sale will not occur for the length of the delay. Since most employment will initially occur during the exploration phase from servicing industries in the local areas, incomes will be lost by the potential workers for the delay period and consequently any revenues to the states and potential public services to the community will also be delayed.

The loss of the potential oil and gas which could have been produced if the sale had not been delayed may have to be replaced by alternative energy sources. The most likely alternative would be imported oil since most other alternative sources have not yet become economically feasible. (See FES on the Proposed 5-Year OCS Lease Schedule published January 1980 for more details about alternative energy sources.) The amount of oil imported would depend on national decisions and the effects of conservation measures undertaken; however, it should be noted that importing foreign oil is not in accord with the President's commitment to decrease our dependence on foreign oil.

Other environmental impacts could occur during the lightering and tankering of imported oil. This will statistically increase the risk of a large oil spill occurring. Since the South Atlantic area does not have the necessary facilities to receive large tankers, the oil would most probably be tankered to the Gulf of Mexico. Should any anchor damage occur to biologically sensitive areas or oil spills occur due to tankering operations, it will be in the Gulf of Mexico area (see Section IV.C.1.). If alternative domestic energy resources are used (coal, nuclear, etc.) environmental damage potentially could be greater than OCS activity impacts. These impacts have been discussed in the DOI 5-year schedule mentioned above.

The potential for recreational fishing, which would have occurred around structures placed on the OCS, will be lost for the period of the delay.

Conclusion for Alternative C

Any employment, business investment and income, community services, and government revenues which would have resulted due to industry activity will be foregone until the sale is reinstituted. This may adversely affect the smaller ancillary business to a greater extent than the larger ones. Recreational fishing would be foregone until structures are erected which act as artificial reefs. Also, if the potential production of this proposed sale is replaced by imported oil, there is a potential risk of large oil spills from tankering/lightering operations.

On the positive side, the impacts associated with Alternative A will be delayed until the sale is reinstituted; time will be gained for completion of environmental studies and development of further studies; state and local planning units can do further planning for industry and community infrastructural stresses; and better resource recovery technology may be developed or enhanced.

D. Alternative D - Withdraw the Sale

1. Description

As discussed in Alternative C there are no known issues at this time which would result in withdrawal of the sale; nevertheless, it is addressed as an alternative in the event it should occur due to unknown factors.

Withdrawing a sale relates to cancelling a sale scheduled for a specific date. The potential for development of tracts within the scheduled timeframe is foregone. However, the opportunity for industry to renominate any of those tracts for inclusion in another sale in that area is still their prerogative. If this sale were withdrawn, there is only one other sale (Number 78) which has been scheduled by the DOI in the South Atlantic area for the five year period 1980-1985. The Call for Nominations is scheduled for March of 1981.

2. Summary of Environmental Consequences

Tracts withdrawn from this sale could be renominated by the industry for Sale 78, but the possibility still exists they may not be included in the final tract list. In that event, the investments made by the companies in pre-leasing activities would not be recoverable.

Any impacts, both positive and negative, which would have occurred under Alternative A would be cancelled. Any impacts which would occur under Alternative C, Delay the Sale, will be applicable to this alternative as well, except that those impacts will have long term effects since there would be no planned reinstitution of this proposed sale. Likewise, should importation of foreign oil replace the lost potential resources of this sale, the same impacts apply as indicated in Alternative C. However, withdrawal would allow an even longer period of time for accomplishment of environmental studies, potential development of resource recovery technology, and additional time for planning activities.

Conclusion for Alternative D

Alternative A impacts will not occur because tracts would be withdrawn from further leasing consideration and, consequently, no oil or gas development activities will likewise occur. Additional time will be gained for studies, planning, and potential development of resource recovery technology. The impacts of importing foreign oil will be as indicated in Alternative C.

III

Section III

Affected Environment

III. AFFECTED ENVIRONMENT

For the purpose of this DEIS, the affected environment has been divided into four zones -- coastal, shelf, slope, and deep oceanic -- which are defined as follows:

Coastal Zone - From inland CZM line of the state out to the Federal/State boundary in the ocean
Shelf - From the Federal/State boundary out to approximately the 200 meter isobath
Slope - From the 200 meter isobath down to the inner edge of the Blake Plateau (Florida-Hatteras Slope)
Deep Oceanic - Although physiographically, the Blake Plateau is an interruption in the continental slope, it will be discussed as Deep Oceanic Environment in this DEIS.

A. Physical

1. Coastal Zone

The coastal zone from Cape Hatteras, North Carolina, to Cape Canaveral, Florida, is characterized by a series of barrier islands and enclosed to semi-enclosed embayments. For a more detailed discussion of the types of estuaries and descriptions of the major harbor estuaries, see Section II.B.1. of the Final Environmental Impact Statement (FEIS) for OCS Oil and Gas Lease Sale 43.

The geology of the coastal zone (onshore) is depicted in visual 2. From Cape Hatteras to Cape Fear, the coast consists of sandy barrier islands with open lagoons. Fine sediments are found in the lagoons. This generalization also applies to the coast from Jacksonville to Cape Canaveral.

Most of the sediments in the coastal zone between Cape Fear and Jacksonville are Holocene in age and consist of the silts and clays which make up the salt marshes between the barrier islands and mainland, fine to coarse sands which make up the barrier islands and their littoral zones, and the fine sands and silts which are found in the nearshore waters. These general classifications frequently exhibit local exceptions, however, and shell material is abundant in the sediments of the coastal zone along the entire southeastern U.S. coast.

For a more detailed discussion of barrier island physiography and formation, see Section II.A.5. of FEIS for Sale 43.

2. Shelf

The continental shelf ranges in width from 33 km off Cape Hatteras to a maximum of 135 km off the Georgia coast. Shelf width off Cape Canaveral is approximately 50 km. The slope of the shelf averages less than $0^{o}10'$ and the water depth at the break averages 50-70 m. Large variations in shelf topography are caused by sand ridges, trending at low angles to the coast; seven or more terraces subparallel to the present shoreline and thought to be old strandlines, and numerous algal banks (along the Carolinas' coasts) and other hard or "live" bottoms that occur as scattered outcrops across the shelf and as an intermittent ridge along the shelf edge (Dillon, et al., 1975).

Almost the entire shelf is covered by the sand size sediments, which is unimodal, well sorted and has a symmetrical grain-size distribution curve. Mean grain size generally increases toward the shelf edge. Shelf sands contain an appreciable amount of calcium carbonate in the form of shell fragments.

The reefs and hardgrounds mentioned before have been studied by Henry as part of the U.S. Geological Survey studies (1977) of the South Atlantic OCS and have been described in three morphotypes. Low-relief hardgrounds exhibit relief of less than one-half meter, are fairly widespread in some areas, support sparse-faunal communities, and are relatively difficult to identify. Moderate-relief hardgrounds have reliefs of two meters or more, support large faunal communities, and are relatively easy to identify on remote sensing instrument records. Shelf-edge reefs are the third morphotype. These features are discontinuous, yet well defined, high-relief ridges at the shelf break which support a large faunal community. Distribution of the hardgrounds is unpredictable and patchy, and is probably influenced by such factors as thickness of Quaternary sediment cover and distribution of Pleistocene river channels.

For more detailed discussion of the physical properties of the continental shelf, slope, and Blake Plateau, see FEIS for Sale 43 and Chapter II of "A Summary and Analysis of Environmental Information on the Continental Shelf and Blake Plateau from Cape Hatteras to Cape Canaveral (1970)" (Volume I, Book 1) by Center for Natural Areas.

3. Slope

The Florida-Hatteras slope is intermediate between the shelf and the Blake Plateau. Although slope gradients rarely exceed 1° (7m/km), irregular topograpy is present that could be relict and/or related to slumping, canyon formation, and erosion by the Gulf Stream. Off North Carolina, the Florida Hatteras slope merges with the Blake Escarpment at the north end of the Blake Plateau. Slumping in this area is discussed and illustrated in Section I.B.2.c. of this document.

Sediment grain-size at the shelf edge and very uppermost section of the Florida-Hatteras slope is medium to coarse sand, which abruptly changes to fine sand to silt sized sediment at depths between 100 and 300 meters (Pilkey, et al., 1977). These finer sediments are thought to be Holocene in age and are areas where deposition may exceed winnowing.

4. Deep Oceanic

As classically defined, the Blake Plateau is not considered a deep oceanic environment, but will be discussed under this heading for convenience. This feature is some 270 km wide at its southern margin where it is bounded by the Great Abaco Canyon and Little Bahama Bank, and it wedges out to the north as the Florida-Hatteras Slope and the Blake Escarpment merge to form the continental slope off of Cape Lookout, North Carolina. The Florida-Hatteras Slope and the Blake Escarpment form the western and eastern boundaries of the Plateau, respectively. Water depths over the Blake Plateau range from 600-1,200 m - the deeper portion being to the southeast in the vicinity of the Great Abaco Canyon. Greatest relief and surface irregularity on the Plateau occurs along the base of the Florida-Hatteras Slope, particularly in the northern portion, and essentially lies beneath the axis of the Gulf Stream. The rough topography appears to primarily result from erosion by the Gulf Stream rather than Tectonic activity, as indicated on seismic profiles in the area.

Rocks as old as Cretaceous age crop out in the erosional zone along the inner edge of the Blake Plateau (see visual 2). Much of the bottom in this area is covered by a manganese-phosphate pavement, with manganese nodules also abundant in places. Within the zone of irregular topography, conical hills have been observed which have relief of over 40 m in some cases. Bottom samples and photographs indicate that the hills are coral mounds. A more detailed discussion of the physical properties of the Blake Plateau may be found in Chapter 2 of "A Summary and Analysis of Environmental Information on the Continental Shelf and Blake Plateau from Cape Hatteras to Cape Canaveral (1977)" prepared under contract for BLM by Center for Natural Areas.

5. Climate

The marine climate overlaying the southeast U.S. continental shelf from Miami to Cape Hatteras is determined by both polar and tropical marine air masses, resulting in a "temperate-rainy" climate with mild winters, long hot summers, and adequate moisture in all seasons. The polar front, the actual zone of maximum temperature contrast which separates the colder continental air from the warmer, more moist, tropical air, both intensifies and shifts southward in the winter to near Cape Hatteras, resulting in a region of intense storm development stretching along the eastern U.S. seaboard from Florida towards northern Europe. Most of the intense extratropical lows develop over the southeast U.S., but show their greatest growth as the storms move offshore over the warmer ocean, especially in the neighborhood of the Gulf Stream.

The meteorological forcing in the South Atlantic Bight (SAB) is thus dominated in winter by transient extratropical storms with considerable variability in strength, structure, and persistence of the important meteorological fields. The predominant winds are from the north, with some 30% of the observed speeds reported by NOAA (1970) exceeding 16 kts. The summer meteorological regime along the Carolina coast is controlled by a significant weakening of the polar front and an intensification of the Azores-Bermuda high. The region of most

intense storm development has shifted north of Cape Hatteras, and while there is still a possibility for storm development over the southeast U.S. shelf, the atmospheric variability there is decreased in summer. The predominant winds are weaker and from the south and southwest. Some 60% of the NOAA-collected surface observations (USDC, NOAA, 1970) indicate wind speeds of less than 10 kts, while 15% indicate wind speeds of greater than 16 kts. Analysis of coastal meteorological data show that the atmospheric pressure and wind fields are highly coherent over the entire SAB throughout the year (Pietrafesa, 1978). Phase relationships indicate northward propagation for disturbances in the energetic period band from 2 days to 2 weeks.

The wind regime in the SAB can be divided into two seasons, summer and winter, with fairly smooth transitions between them. In winter, except for the extreme south (Miami), the region is dominated by extratropical cyclones, and this shows a great deal of variability on time scales of a few days. Mean winds are generally from the northwest quadrant. In summer, the wind shows less variability and less energy. The fluctuations are predominantly in the longshore direction except for Florida.

The most predominant characteristic of the wind field at all seasons is the high degree of coherence over very large distances. Thus, fluctuations of the wind at Jacksonville are closely related to wind fluctuations in the center of the SAB as measured by the NDBO surface meteorological buoys and also wind fluctuations at Wilmington and Cape Hatteras, North Carolina. Indeed, fluctuations in the N-S component of the wind are often highly correlated between Miami and Cape Hatteras. The E-W components are less coherent over this large distance.

Along the southeastern seaboard region, precipitation is moderately hearvy, averaging about 48-56 in. a year. Monthly departures may be large in any individual year, but over a long period of record, 50-75 years, a fairly uniform pattern prevails.

In the northern part of the area, maximum rainfall occurs normally during July and August, and minimum rainfall in November. In the southern section, however, maximum rainfall occurs in August, September or October, and the minimum in December, January or February. Average monthly totals at most stations range from 2-6 in. throughout the year. During the months of greatest hurricane frequency, excessive rains of 9-15 in. in a 24-hour period have been recorded. These may occur at any point along the coast, but are most common in the southern part of the area.

The monthly mean number of days with 0.01 in. or more of precipitation in the northern part of the area ranges from about 8-10 days a month in the fall to 10-12 days a month in the summer and winter. In the central part of the area, the most rainy days are in summer, 11-16 days a month, and the least in the spring and fall, 6-9 days a month. The most rainy days along the Florida coast, 14-18 days a month, generally occur in late summer and early fall, and the minimum number, 5-8 days a month, from February through April.

Much of the precipitation is associated with cyclonic activity throughout the year. During the winter, precipitation is usually general but may come with occasional thunderstorms associated with fronts. During the summer, when the area is dominated by the Azores High and cumulus clouds predominate, precipitation is localized and is showery in nature.

Thunderstorms along the coast occur on an average from 40 days a year in the north to 80 days a year in the south. Maximum occurrence is from June through August, and an average of 7-19 thunderstorms a month occur during this season.

Snow falls from December through March in the northern part of the area 1 or 2 days a month. As far as coastal operations are concerned, snow precipitation is not significant since most of the area is entirely free from snow the year round.

Visibility is generally good throughout the year over the entire area. Fog is the principal restriction to visibility. In general, fog decreases from north to south, and the worst fog conditions occur during the winter when air masses change frequently. Visibility is usually poorest during the night and early morning.

In addition to fog, precipitation occasionally reduces visibility over both land and water, and haze and smoke sometimes restricts visibility over land.

Along the coast, radiation fog is frequent, forming shortly after sunset. These fogs generally do not extend any great distance seaward, but may seriously restrict harbor activities. Sea fogs sometimes drift onshore on hot summer days, persisting for many hours in a shallow layer along the coast. Over the land, dispersal usually begins at the surface giving the effect of lifting. Over the water, fog generally persists at the surface and restricts visibility until the last vestige of the formation disappears.

The occurrence of heavy fog at land stations between Cape Hatteras and Cape Canaveral varies from an average of 6 days during January at Daytona Beach to less than 1 day a month at Cape Hatteras during July and September. Heavy fog is most frequent at Savannah with an average of 44 days a year and least frequent at Wilmington with an average of 25 days a year.

Tropical cyclones differ from extratropical cyclones in that extratropical cyclones obtain their energy from the variances of temperature and moisture in air masses within the circulation; whereas tropical cyclones obtain energy from the latent heat of condensation of water vapor. The average diameter of a tropical cyclone is between 96-965 km at maturity.

Tropical cyclones are classified by stages according to the sustained surface wind speeds. The most intense stage, called a great hurricane, has winds in excess of 109 kts. The hurricane has sustained surface winds from 64-108 kts. Tropical storms have sustained winds 34-63 kts. Tropical depressions have sustained winds not exceeding 33 kts. (see Section IV.C.1.a.(4)).

Location and environment determine the development and dissipation of tropical cyclones. They form in ocean areas having a high surface temperature, 25^{o}-$27^{o}C$, with the greatest number occurring in the late summer and early fall in the Northern Hemisphere. After formation, the pull of the Easterlies causes a tropical cyclone to make a curved path from east to west. In some instances, tropical cyclones will reverse their direction of travel, a phenomenon call "recurving." If the storm's tract crosses over land, the storm rapidly dissipates as a result of the removal of the oceanic energy source.

The coastal region has generally experienced tropical cyclones of one type or another as early as May 28 and as late as December 2. The portion of the region near Miami is the most likely to experience a hurricane in any one year (16% probability). Probability drops to less than 2% northward along the coast in the Jacksonville area, rises back up to 8% in the Charleston area, and stays uniformly high, peaking again at 11% probability at Cape Hatteras.

6. Earthquakes

Although the eastern U.S. is an area of generally low earthquake activity, the largest earthquake to have occurred in the eastern U.S. occurred near Charleston, S.C. in 1866. This earthquake of about 6.8 Richter magnitude (Bollinger, 1977) was felt as far away as Boston, Massachusetts; Green Bay, Wisconsin; Cuba and Bermuda and caused structural damage for several hundred kilometers.

Only one small earthquake is known historically to have occurred on the shelf or Blake Plateau (Tarr, 1977), but seismicity on the Coastal Plain of South Carolina appears to define a narrow zone which strikes northwest through Charleston, South Carolina. The linearity of the zone and an offset of an unconformity inferred to be of Early Jurassic or Late Triassic age on the shelf along trend suggests that the South Carolina seismicity may be related to stresses along the landward extension of the Blake Spur Fracture Zone (Dillon, 1979; Sbar and Sykes, 1973), a location of major offset during early Atlantic basin development. The likelihood of a large magnitude earthquake recurrence along the zone is presently being studied by USGS and associated researchers. Presently, such a recurrence must be considered a possibility.

7. Geology

After final tract selection for proposed Sale 56, the Resource Evaluation Section of the Conservation Division - Eastern Region, U.S. Geological Survey, let a contract to survey each of the blocks selected for the lease sale with remote sensing seismic instruments to determine if any geological conditions exist which could be hazardous to OCS oil and gas exploration. If any engineering constraints are found, the potential hazards to exploration activity will be mitigated by special geological lease stipulations applied to those specific tracts where the potential hazards exist.

Regional surveys conducted through the BLM Environmental Studies Program, primarily by Marine Geology Division of U.S. Geological Survey, have provided some indication of the different types of potential geological hazards to be expected, and which are discussed below.

Faults

Two types of faulting have been detected in the vicinity of some of the tracts in proposed Sale 56. Small displacement (1-3 m) faults occur on the continental shelf mostly south of Charleston, S.C., and are particularly abundant east of Savannah, Georgia. Faults of the same character, but of larger displacement (10-30 m) occur on the inner Blake Plateau. The smaller faults on the continental shelf mainly displace Miocene and Oligocene age rocks, do not reach the seafloor, and appear to die out with depth. The faults of the inner Blake Plateau appear to be confined to rocks of upper Cretaceous age, as they terminate against Paleocene age rocks and with depth. Both of these types of faults are believed to be caused by compaction of Upper Cretaceous calcareous sediments (Dillon, 1979).

The other type of faulting observed is a major growth fault which occurs off the North Carolina coast (see figure III-1 and visual 2). This fault, as is typical of growth faults, shows increasing displacement with depth (see figures III-2 and III-3). Some 3 m of offset can be seen at a depth of 40 m below the seafloor and at a depth of 5 km, the displacement appears to be on the order of 500 m. This fault strikes north-northeast for some 50 km, dips steeply to the southeast, and is the largest fault known to offset the Tertiary sediments on the Atlantic coast. The possible mechanism proposed for causing this faulting is the removal of salt from a salt bed at depths resulting in the formation of diapirs further seaward. A number of splay faults are associated with the fault trend (Sylvester, et al., 1979).

Faults which occur near the seafloor are considered an environmental hazard as they could cause loss of drilling fluids and could serve as conduits to allow high pressure gas to escape to the surface, which may result in blowouts or fires. If the locations of faults are known, the hazards they pose can be minimized through casing design and drilling procedures.

Slumps

Along the continental slope from Cape Hatteras to Jacksonville, Florida, areas of slumping are present locally, but their occurrence appears to be rare. Rotational faults associated with slumping have been observed and appear relatively common along the northern outer edge of the Blake Plateau. Areas of jumbled bedding in sediments were observed downslope from some of the rotational faults (Dillon, 1979) (see figure III-3).

Sediment instability could obviously be hazardous to bottom-supported equipment. If locations of such conditions are known prior to any activity, the potential hazard can be mitigated through relocation or design of equipment.

Scour

The inner Blake Plateau is severely scoured by Gulf Stream currents. Most of the Tertiary sediments either have not been deposited or have been eroded, leaving a series of mesas and plateaus, which expose upper Cretaceous and Paleocene age rocks (see visual 2). Slopes are steep in places and are supported by a pavement of manganese and phosphorite nodules.

Scour around structural supports and problems in the setting of risers and other structures without especially designed equipment can be expected on the inner Blake Plateau.

Clathrates

A clathrate, also known as a frozen gas-hydrate, is an icelike crystalline lattice of water molecules in which small gas molecules such as methane, ethane, and H_2S become trapped. Clathrates appear stable under temperature and pressure conditions of the deep sea and have a strong tendency to form under conditions where water and sediment are saturated with gas (Paull and Dillon, 1980; Tucholke, et al., 1977). Clathrates appear on seismic reflection profiles as bottom-simulating reflectors (BSR) which often cut parallel to the bottom and across normal bedding. Deep Sea Drilling Project holes 102, 103 and 104, which were drilled where a BSR has

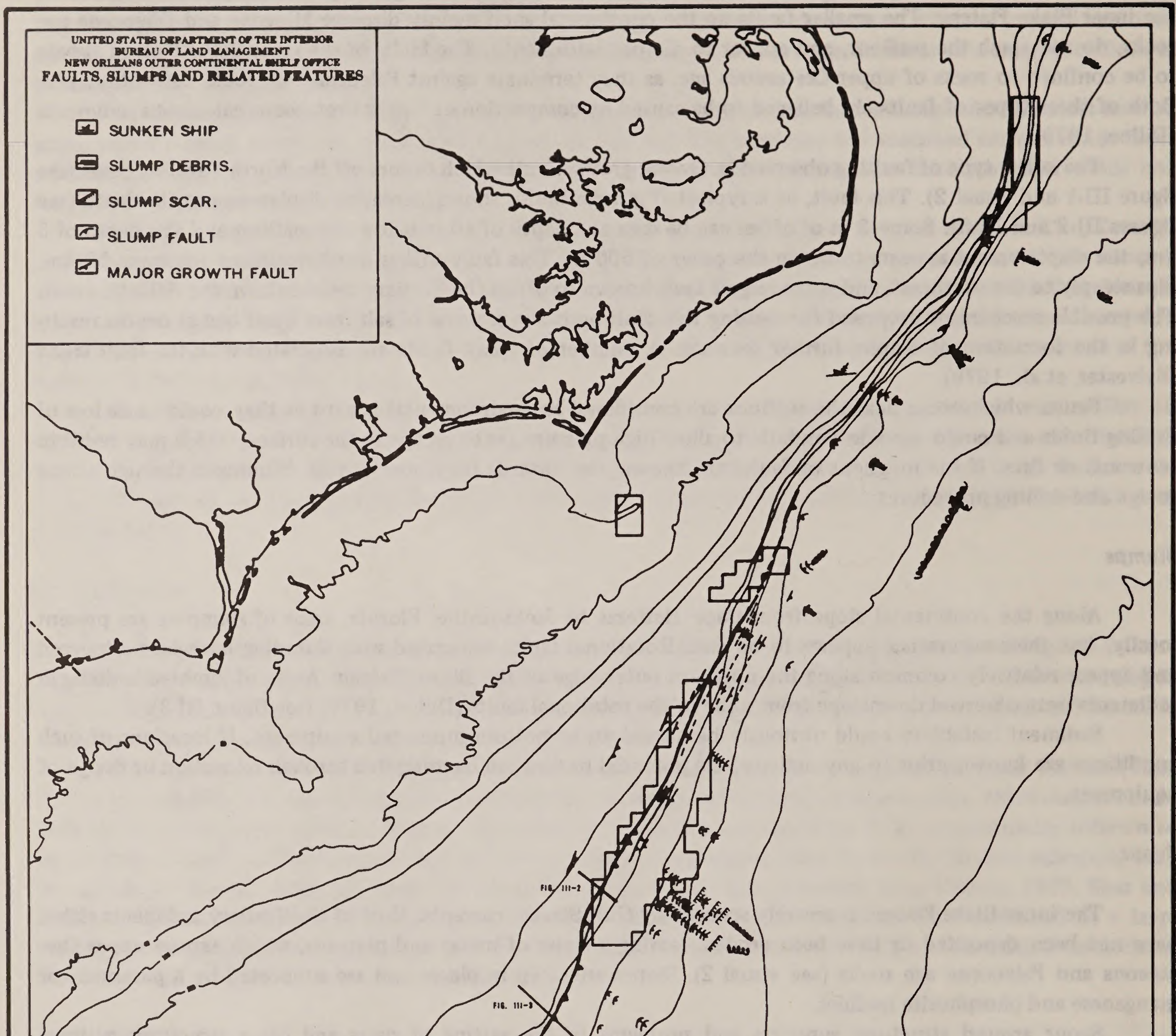


FIGURE III-1. FAULTS, SLUMPS AND RELATED FEATURES IN THE U.S. SOUTH ATLANTIC OCS REGION

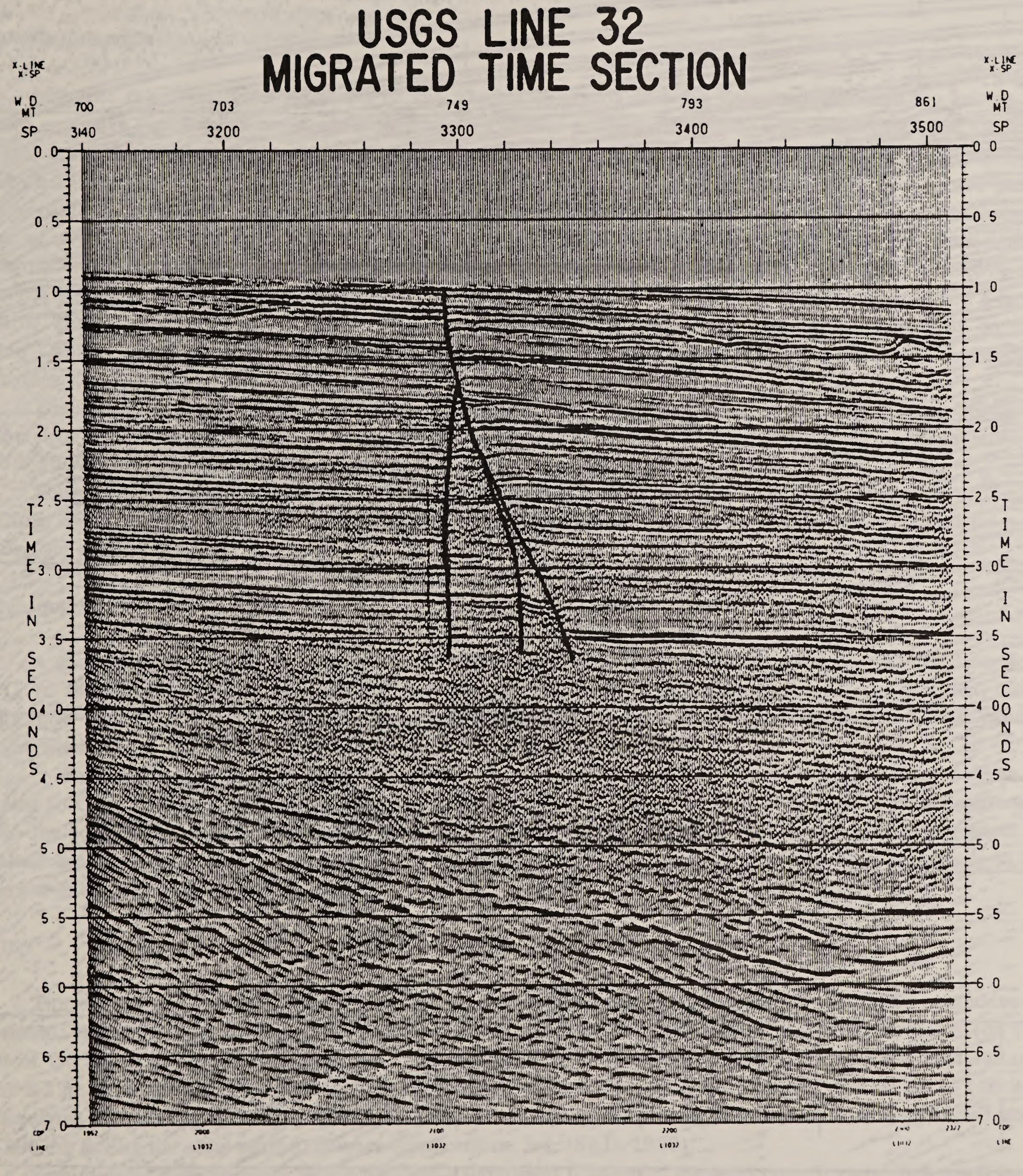


Figure III-2 — Common depth point seismic reflection profile showing the major growth fault in the Sale 56 area. The throw on the fault increases with depth from 1 meter at 10 meters depth to over 500 m at 5 km depth (3.5 sec).

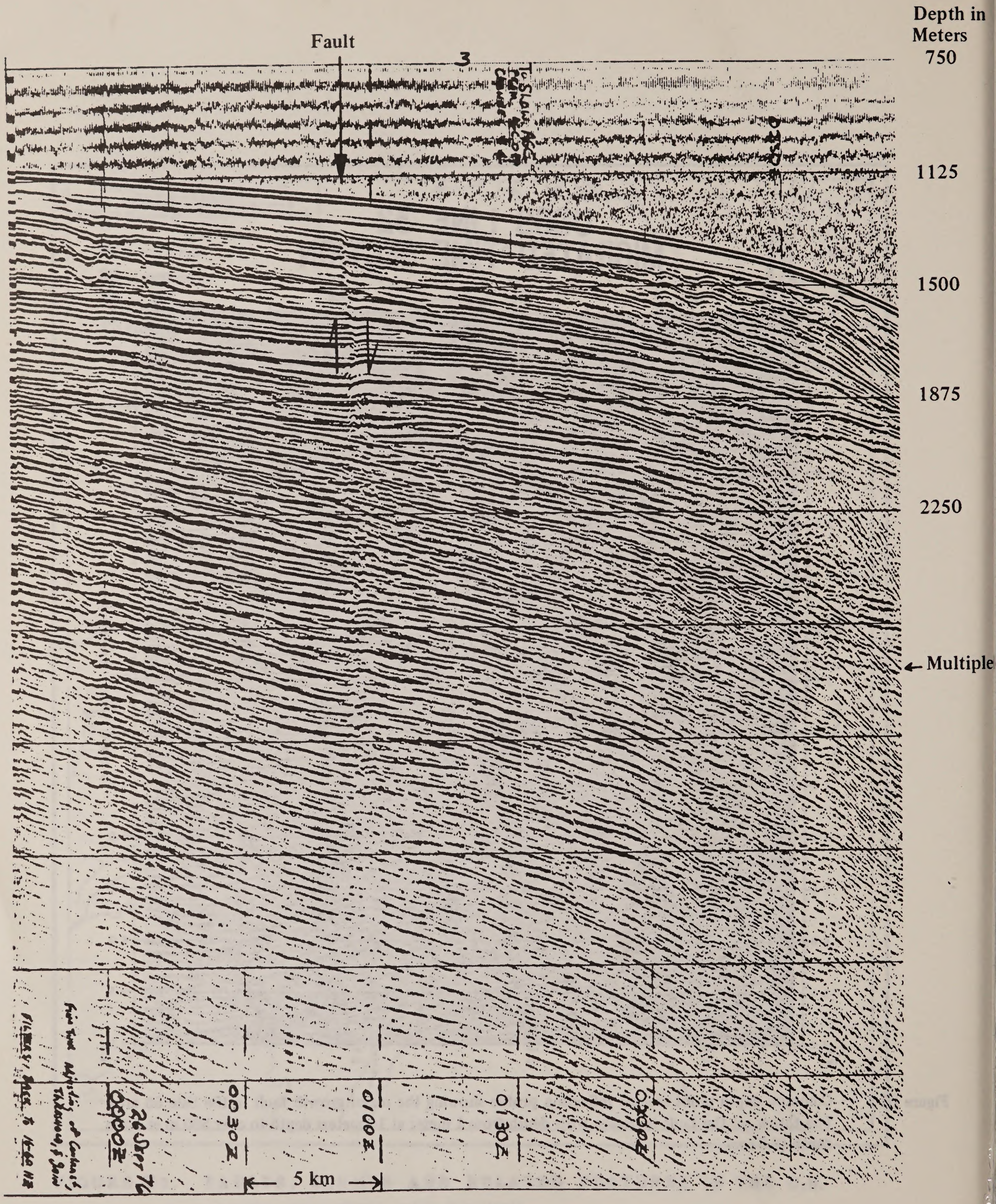


Figure III-3 — Single channel airgun record of growth fault. Location shown on figure III-2 (Popenoe, 1980).

been mapped, found large quantities of gas in the sediments. Cores from these holes slowly released large quantities of gas after exposure on the deck of the drill ship. Such slow release of gas is consistent with the breakdown of gas-hydrates. The BSR occurs at a subbottom depth of 400-700 m in water depths of 800-3800 m (see figures III-4, 5, 6, and 7).

According to Dillon and Paull (1980), gas-hydrate cemented layers may prove to be important seals in forming gas traps at relatively shallow subbottom depths. Drilling through such layers, however, may require new engineering techniques to provide proper seals around casings.

Cavernous Limestones

Many of the limestone formations of the Florida Peninsula and the Bahama Banks area are known to contain extensive networks of caves which may present serious problems in drilling and completing wells. Cavernous limestones are particularly prevalent in the shallower Tertiary sections where erosion and solution may have taken place during Pleistocene times when the sea stood at lower levels. Cavernous limestones have caused problems in drilling exploratory wells in the past. During the drilling of Bahamas Oil No. 1 Andros Island well, circulation of drilling mud was lost in about 15 zones, and during the drilling of the ESSO No. 1 Hatteras Light, cavernous porosity was encountered in lower Cretaceous carbonates between depths of 2,550 and 2,575 m.

A submarine spring has been mapped two and one half miles off Crescent Beach, Florida, and a large sinkhole known as Red Snapper Sink was discovered farther offshore. Seismic-reflection profiles run by the Marine Geology Division, U.S. Geololgical Survey, off Florida in the vicinity of these features indicate that subsurface Karst (sinkhole) features may also be present in the area.

The extent of cavernous porosity on the continental shelf is not known, but is probably more prevalent on the shelf off Florida. On the inner Blake Plateau, the presence of cavernous porosity near 31°15'N latitude and 79°15'W longitude appears to occur in upper Cretaceous age rocks (Dillon, 1979).

Thus, caverns may exist throughout the Sale 56 area which may constitute a threat to bottom mounted platforms and structures or cause drilling problems unless proper remote sensing surveys are conducted prior to exploratory activity.

8. Oceanography

A good general description of physical and chemical oceanographic conditions was given in Section II.B. and C. of the Final Environmental Impact Statement for Sale 43. Since publication of that document, more results have been received from oceanographic studies in BLM's Environmental Studies Program. Those results are presented here.

The South Atlantic U.S. Continental Shelf, known as the South Atlantic Bight, (SAB) extends from Cape Hatteras to Cape Canaveral and is bounded to the west by a series of barrier islands with tidal inlets and estuaries, and to the east by the Gulf Stream, which tends to follow the continental slope as it flows north. Water depth at the shelf break, which is critical to shelf water/Gulf Stream interactions, varies from 50-75 m and tends to be shallower in the southern part of the Bight.

a. Tides

Throughout the South Atlantic Bight, the semi-diurnal component dominates all other tidal components. In general, the tidal range tends to increase toward the middle of the bight reaching a local maximum (on the order of 2-3 m) in the vicinity of Savannah. The maximum range is approximately 0.9 m at Cape Hatteras and about 1.2 m at Cape Canaveral. Bottom pressure records collected off Savannah indicate tidal ranges of 100-240 cm occurring on a 28 day cycle at mid-shelf, and 60-190 cm at the shelf break. The coastal tidal range varied from 180-300 cm during the same period (Science Applications, Inc. (SAI), 1980).

Semi-diurnal tidal currents which produce a significant fraction of the total current variability result from a wave which travels primarily in an onshore-offshore direction. At mid-shelf off Georgia, the cross-shelf component has higher amplitudes than the along-shore component. Also, a local maximum of tidal current amplitude occurs at mid-shelf.

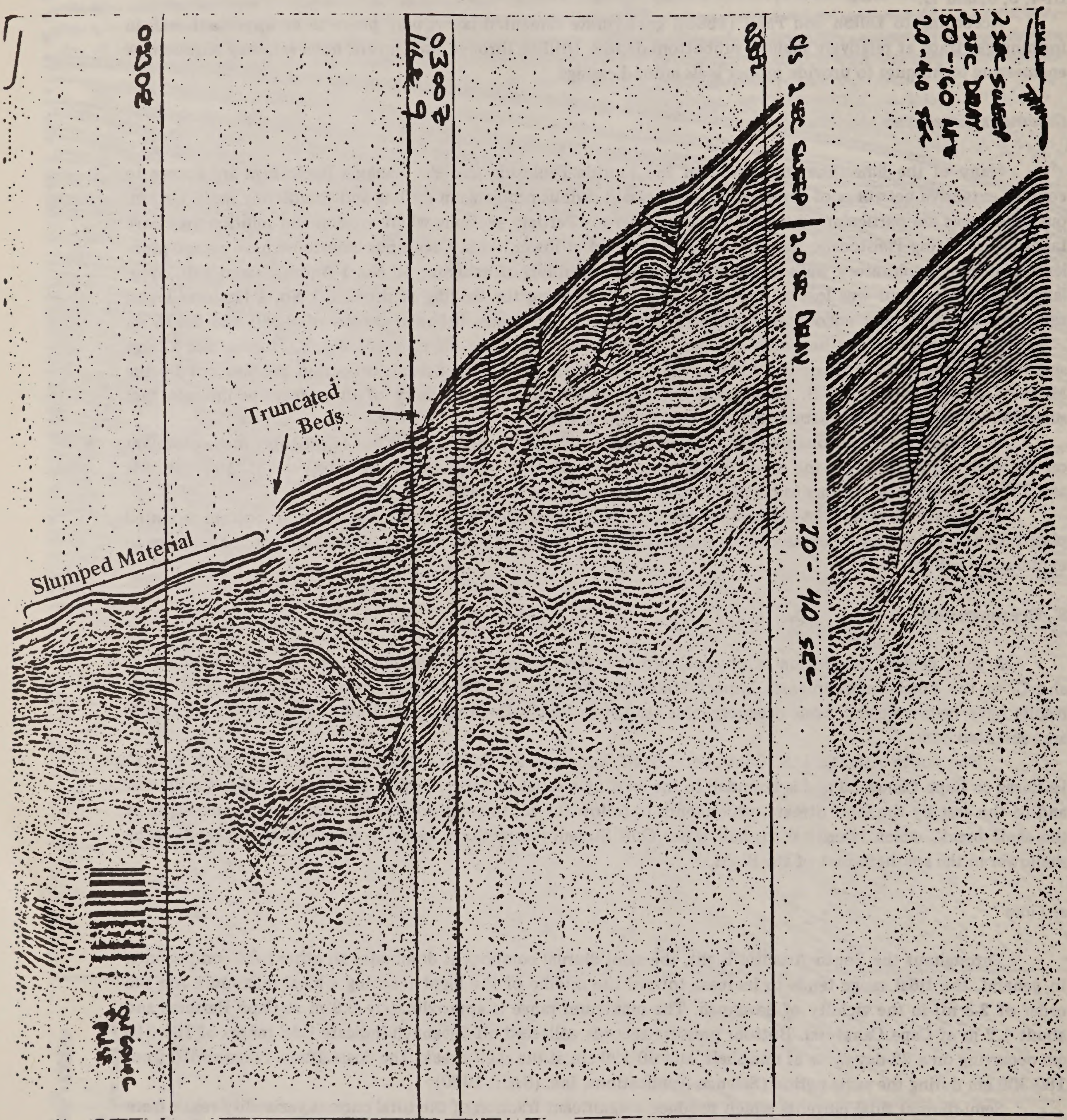


Figure III-4 — Single channel airgun of rotational slump faults, truncated beds and slumped material on Blake Escarpment (from Popenoe, 1980).

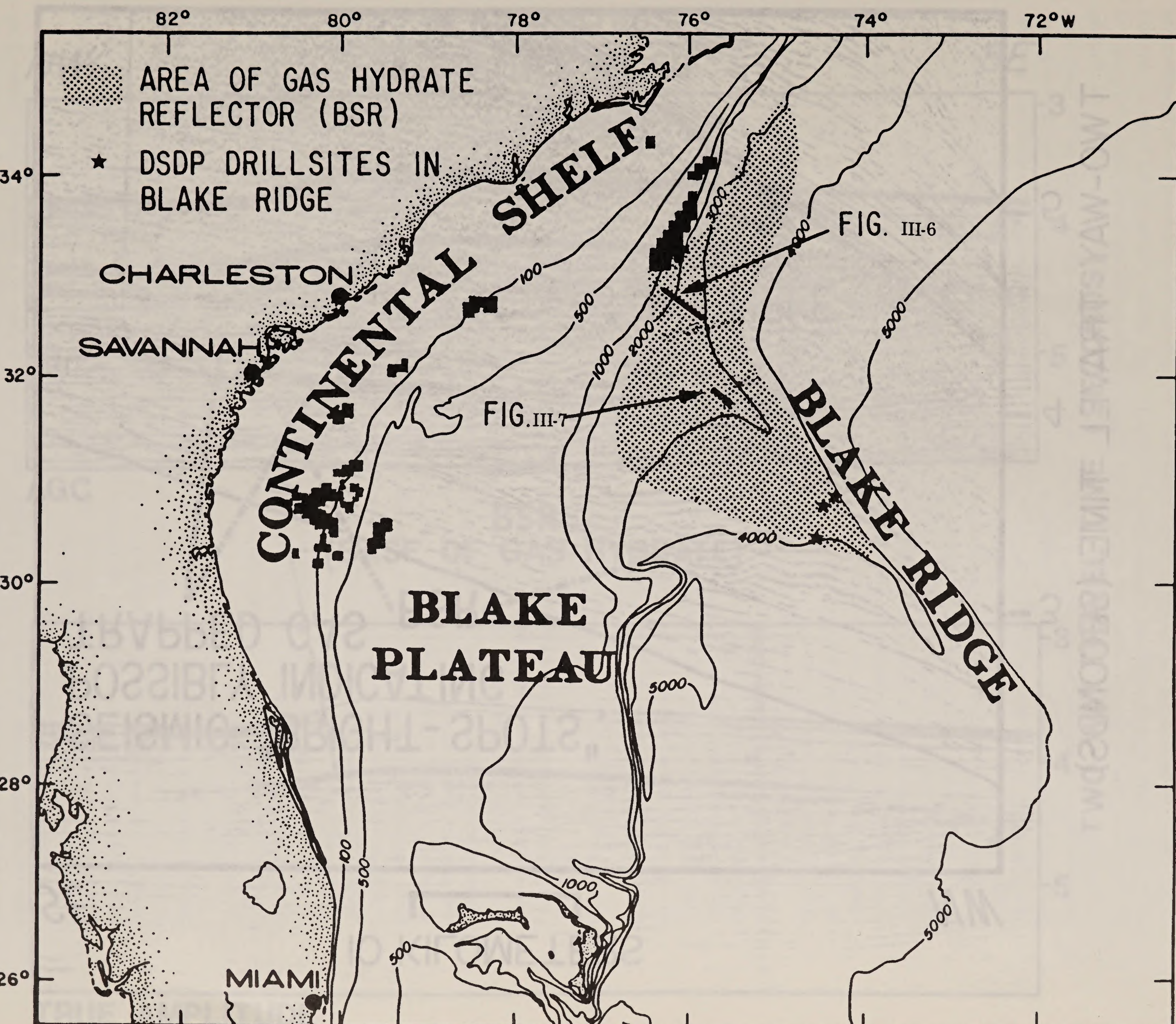


Figure III-5 — Area of Gas-hydrate Reflector.

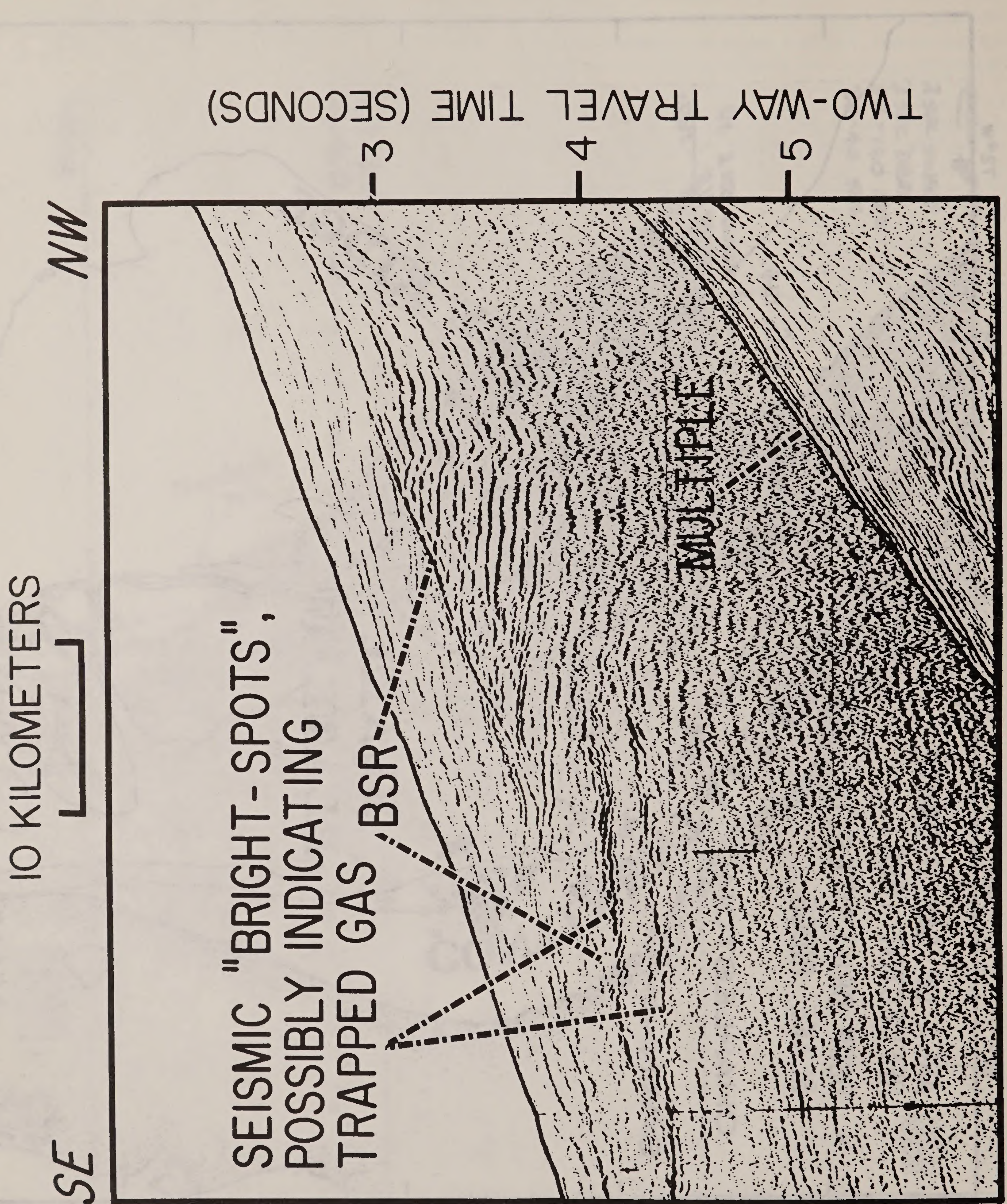


Figure III-6 — Gas-hydrate zone possibly sealing beds and forming a reservoir on the Blake Escarpment (from Dillon, et al., 1980). Location shown on figure III-5.

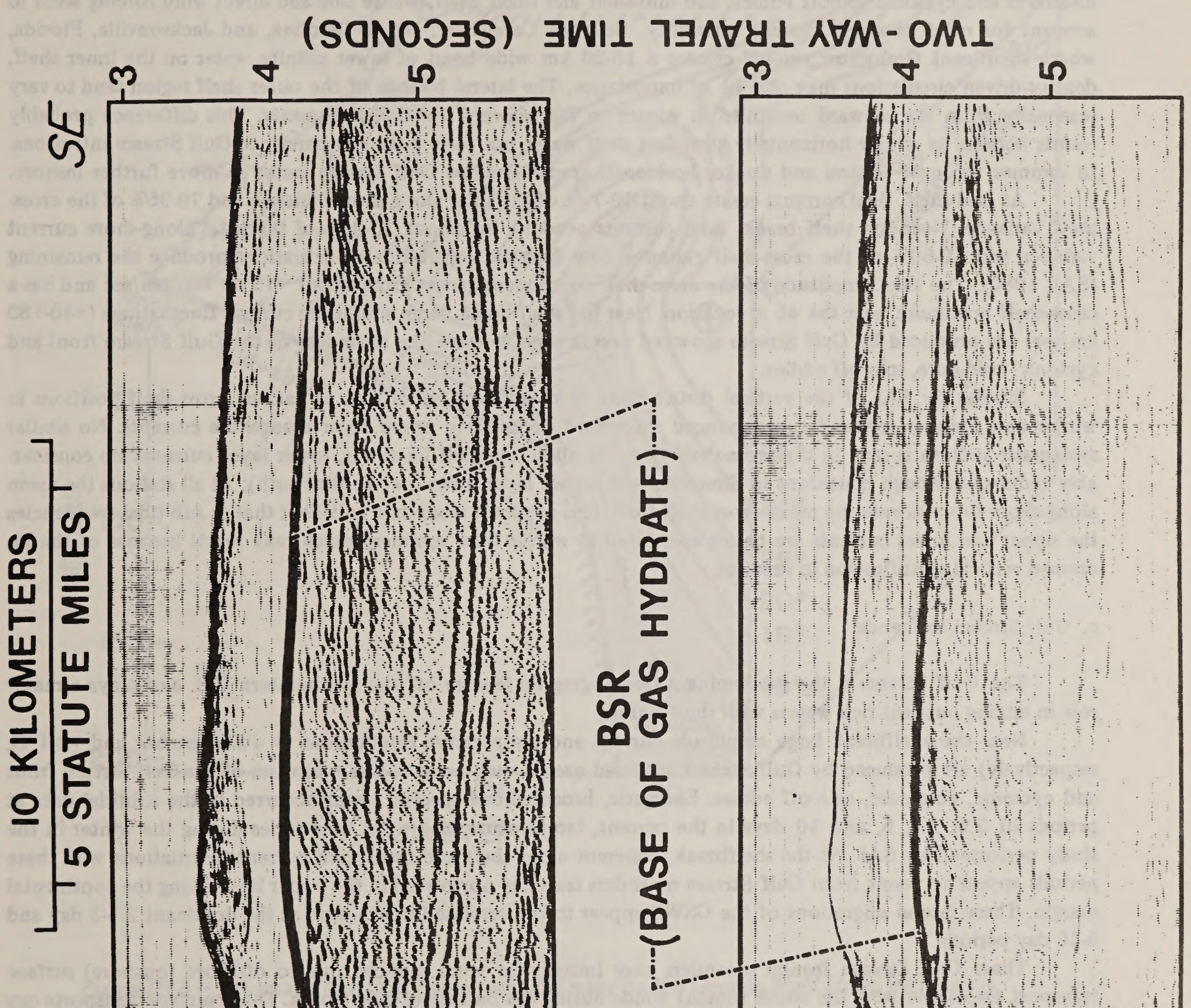


Figure III-7 — Bottom Simulating Reflector (BSR) intersecting bedding, indicating the base of the gas-hydrate (from Dillion et al., 1980). Location shown on figure III-5.

b. Circulation

Based on mechanisms controlling observed circulation, three generalized shelf flows can be identified: the outer shelf, where current variations are produced primarily by Gulf Stream forcing in the form of wave-like meanders and cyclonic spinoff eddies; and mid-shelf and inner shelf, where tide and direct wind forcing seem to account for most observed current variability. Between Cape Fear, North Carolina, and Jacksonville, Florida, where significant freshwater run-off creates a 10-20 km wide band of lower salinity water on the inner shelf, density-driven circulations may also be of importance. The lateral bounds of the outer shelf region tend to vary seasonally from the seaward one-third in winter to the seaward one-half in summer. This difference probably results because in winter horizontally stratified shelf water can form a density barrier to Gulf Stream intrusions. In summer, stronger vertical and weaker horizontal gradients allow Gulf Stream water to move further inshore.

At mid-shelf, tidal currents create about 40-70% of the total along-shore variance and 70-95% of the cross-shelf variance. Near the shelf break, tidal currents account for about 10-25% of the total along-shore current variance and 40-60% of the cross-shelf variance; low frequency (sub-tidal) fluctuations produce the remaining (SAI, 1980). The tidal amplitude of the cross-shelf component ranges from about +15 to +50 cm/sec and has a cross-shelf maximum near the 45 m location. Near the shelf break, large amplitude current fluctuations (+40-+80 cm/sec) are produced by Gulf Stream spawned events such as wave-like meanders of the Gulf Stream front and cyclonic, cold-core, spin-off eddies.

Studies by SAI of the vertical distribution of mean flow conditions at various cross-shelf positions in winter and summer revealed a pronounced shoreward decrease in upper layer alongshore currents. No similar systematic pattern is seen in the cross-shelf flow. At all across-shelf locations, lower layer currents are considerably reduced although consistent in direction with upper layer flows (i.e., to the north). At all stations the mean along-shore flow exceeds the mean cross-shelf flow. It is apparent from data collected that at sub-tidal frequencies the upper and lower currents are better correlated in winter than summer, which may result because of the increased vertical stratification in summer.

c. Gulf Stream Influence

The Gulf Stream is the predominant oceanographic feature off the southeastern U.S. and plays a major role in mixing nutrient-rich waters with shelf waters.

Near the shelfbreak large amplitude current and temperature fluctuations (+ 40-80 cm/sec and +2-4°C, respectively) are produced by Gulf Stream spawned events such as wave-like meanders of the Gulf Stream front and cyclonic, cold-core, spin-off eddies. Energetic, broadbanded spectral peaks occurred in the subtidal data at periods of 2.5, 3.5, 5, and 10 days in the current, temperature, and wind time series during the winter in the study performed by SAI. At the shelfbreak, coherent along-shelf and cross-shelf current fluctuations with these periods appear to result from Gulf Stream meanders traveling northward in the upper layer along the continental margin. These lateral migrations of the GSWB appear to be correlated to the wind at the dominant 2.5-3 day and 5-10 day periods.

These Gulf Stream frontal meanders may initially be wind induced due to offshore (onshore) surface transport associated with the south (north) winds during the passage of cold fronts. These surface transports can also produce upwelling/downwelling, respectively, which may be in phase with and can enhance that produced by the meander (see figure III-8).

Current meter, hydrographic, and satellite sea surface temperature data show that the folded wave-like patterns commonly displayed in satellite imagery of the Gulf Stream boundary off the SAB are produced by the evolution of cyclonic, cold-core, spin-off eddies. Horizontal wave-like meanders of the Gulf Stream western boundary travel northward along the shelf edge in the upper layer. Due to the large horizontal and vertical shear in the frontal region, these distributions can become unstable and eventually grow into cyclonic spin-off eddies, which appear as tongue-like extrusions of Gulf Stream water flowing south over the shelf. The initial frontal disturbance appears at times to be wind triggered.

These filaments of Gulf Stream water can, at times, extend well onto the shelf and can significantly affect observed surface currents. Material in close proximity but on opposite sides of a filament or Gulf Stream boundary can have widely divergent paths, with material in Gulf Stream water usually being transported rapidly to the

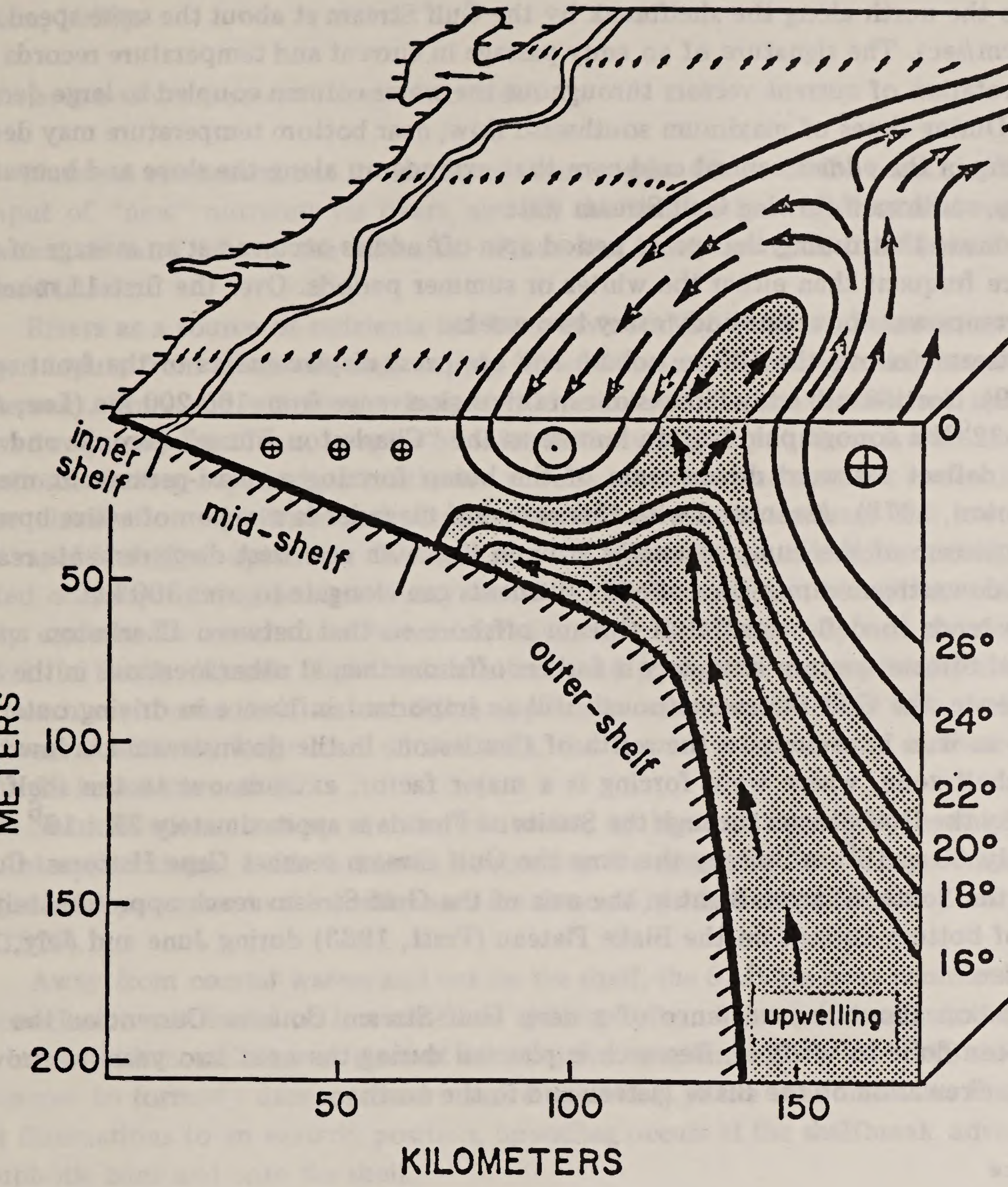


Figure III-8 — Schematic of a Gulf Stream spin-off eddy on the Georgia Shelf (from SAI, 1980).

north. Material in mid-shelf water has a long term trajectory more reflective of wind driven surface currents. Some evidence suggest that a bi-directional exchange can occur across a Gulf Stream front although movement of surface water into the Gulf Stream is the general pattern.

Eddies are advected to the north along the shelfbreak by the Gulf Stream at about the same speed as the meanders (average about 45 cm/sec). The signature of an eddy passage in current and temperature records from, the shelf break is a cyclonic rotation of current vectors throughout the water column coupled to large decreases in near bottom temperature. During times of maximum southward flow, near bottom temperature may decrease as much as 6^{o} due to upwelling in the eddies central cold-core that extends up along the slope and beneath the near surface extrusion of warm, southward flowing Gulf Stream waters.

Current meter data indicate that during the spring period spin-off eddies occurred at an average of about one per week, which was more frequent than either the winter or summer periods. Over the first 11 months of data, the average rate of occurrence was about one eddy every two weeks.

South of 32^{o}N the Stream follows the 100 m isobath and east-west displacements of the front seldom exceed 25 km (Legeckis, 1979). North-south eddy dimensions in this region range from 100-200 km (Lee, Atkinson and Legeckis, 1980). At 32^{o}N a topographic feature known as the "Charleston Bump" (Brooks and Bane, 1978) causes the Stream to deflect eastward downstream of the bump forming a quasi-permanent meander (Pietrafesa, Atkinson and Blanton, 1978). Associated with this eastward meander is a region of active upwelling in the lee of the bump. Downstream of the bump meanders grow in size with east-west displacements reaching 100 km (Legeckis, 1979), and downstream dimensions of eddy filaments can elongate to over 300 km.

The Charleston Bump tends to deflect the Gulf Stream offshore so that between Charleston and the vicinity of Cape Fear, the Gulf Stream western boundary is further offshore than at other locations in the South Atlantic Bight. As a consequence, the Gulf Stream, although still an important influence in driving outer shelf currents, is not as important as it is in regions to the south of Charleston. In the downstream shadow of the Charleston Bump, the cross-shelf zone, where wind forcing is a major factor, extends out to the shelf edge.

Total water transport by the Gulf Stream through the Straits of Florida is approximately 32×10^{6} m^{3}/sec and increases to approximately 63×10^{6} m^{3}/sec by the time the Gulf Stream reaches Cape Hatteras. Current velocities along the length of the South Atlantic Bight in the axis of the Gulf Stream reach approximately 200 cm/sec. Measurement taken of bottom current on the Blake Plateau (Pratt, 1963) during June and July, 1961, show speeds averaging 25 cm/sec.

There has been speculation about the existence of a deep Gulf Stream Counter Current on the Blake Plateau, but little work has been done to verify it. Research is planned during the next two years to provide a more complete picture of deep circulation on the Blake Plateau and to the north.

d. Turbid-Clear Water Interface

Along the coast where turbid estuarine water discharge meets offshore water, a very distinct interface can be observed. Previous studies suggest that around these fronts surface currents tend to converge toward the front. Thus, it is expected that floating material would accumulate on the front and be transported with the front as it migrates.

SAI, under contract to BLM, evaluated the effectiveness of the coastal front as a barrier to pollution by documenting and examining the behavior of floating and dispersed pollutant simulators. Using LANDSAT imagery to determine the presence and extent of Turbid-Clear Water Interface (TCWI), and knowing environmental factors such as tidal stage, local meteorological conditions in a three-day window surrounding the documented conditions, and winds at the time of imaging, key parameters controlling the presence and extent of the TCWI can be isolated. The TCWI was clearly dependent on tidal state. Offshore fronts were seen when tidal currents at the mouth of the bordering estuaries were in the latter half of ebb and first half of flood. During the second half of flood tide and the first half of ebb, fronts were at best broken, irregular, or absent. Under certain conditions, strong winds apparently caused sufficient mixing to eliminate a sharp boundary in the images. Instead, a more diffuse turbid gradient existed.

Results of these studies suggest that fronts associated with tidally dominated estuarine discharge plumes may only act to temporarily delay pollutant migration. Even if fronts were readily maintained during all condi-

tions, the fronts often move back into the estuary at some time during the flooding tide. If ambient along-shore shelf currents are sufficiently vigorous, a plume may become detached, but the embedded pollutant may very well be drawn into one of the other tidally dominated estuaries along the coast of the Georgia Embayment (Blanton, 1980).

e. Nutrients and Chlorophyll (from SAI, 1980)

Nutrient concentrations in nearshore areas within 40 km of the coast are determined by two factors: (1) the input of "new" nutrients via rivers, and (2) the balance between bacterial regeneration and phytoplankton utilization. A third factor, the intrusion of nutrient laden upwelled Gulf Stream water also occurs and will be discussed later.

Rivers as a source of nutrients has been reviewed by Windom, Dunstan, and Gardner (1975). They found nitrogen inputs from rivers can only supply 20% of the marsh nitrogen requirement but all of the phosphorous requirement. They and others conclude that riverine sources are insufficient nutrient sources considering the observed requirements. Thus, in spite of this relatively high input, there is little impact on ambient nutrient concentrations. During a period of maximum runoff, when surface nutrient concentrations should be highest, the surface distribution of nitrate and silicate showed low concentrations. The low concentrations are a result of either rapid biological uptake or chemical removal (flocculation, adsorption, etc.). Since salinity is conservative, affected only by mixing processes, any variables, such as nitrate, phosphte, or silicate, that plot linearly with salinity can also be assumed to be conservative, that is, affected by non-physical processes such as biological removal. In South Atlantic Bight waters nitrate and phosphate are apparently removed at the river mouth and never reach even inner shelf waters. Silica appears to mix conservatively into shelf waters. Thus, although rivers may bear a relatively large load of nutrients, the impact is apparently restricted to the very nearshore zone (within 20 km of the coast).

Nutrient concentrations are also controlled by bacterial regeneration which released nutrients previously fixed into plant tissue. Little is known concerning the rates of nutrients regeneration although it has been shown that bacterial processes in the coastal area are seasonal, presumably because of temperature effects (Atkinson and Hall, 1976).

Away from coastal waters and out on the shelf, the SAB has been commonly thought to be unproductive. This conclusion was based on low observed chlorophyll and nutrient concentrations in outer shelf waters. It has now, however, become clear as a result of intensive sampling efforts that SAB shelf waters are highly productive in response to formerly unrecognized massive upwelling at the shelfbreak. As the Gulf Stream moves in its frequent fluctuations to an easterly position, upwelling occurs at the shelfbreak, advecting nutrient laden water into the euphotic zone and onto the shelf.

Lee, Atkinson, and Legeckis (1980) were able to quantify the flux of nitrogen into outer shelf waters resulting from these upwelling processes. Haines (1974) estimated the annual river input as 12,600 tonnes N yr^{-1} and atmospheric at 7,600 tonnes N yr^{-1} over one eddy length. Since eddies pass every 5-12 days, the yearly flux is much larger, possibly 70,000 tonnes N yr^{-1}, clearly much larger than other sources.

Spatial chlorophyll patterns can be explained by considering the location of the sources of "new" nitrogen to the SAB shelf: (1) rivers and estuaries, and (2) upwelling at the shelfbreak. The outer shelf lacks a true seasonal cycle in phytoplankton biomass. High, or low, phytoplankton biomass can be found during winter or spring depending on whether upwelling is encountered.

A major problem in interpreting chlorophyll distributions of the outer shelf is that the fields change rapidly and high chlorophyll features are relatively small (1-20 km wide, greater than 100 km long). Thus, station spacing and transect location influence the interpretation to a considerable extent. This situation contrasts sharply with the Middle Atlantic Bight where general seasonal blooms characterize the shelf. The reason for the difference is that, unlike the Middle Atlantic Bight, the SAB lacks a subsurface shelf reservoir of high nutrient water. Thus, upwelling of nutrient rich water located seaward of the shelf is the dominant source of nutrients for the outer shelf portion of the SAB.

During summer, nutrient-rich subsurface intrusions of deeper nutrient-rich water move onto the SAB shelf, and often high chlorophyll concentrations result. Two features of the SAB account for the high subsurface

chlorophyll within intrusions. First, the shelf is relatively shallow (less than 50 m), and secondly, surface water overlying intrusions is very clear. As a result, subsurface intrusions are within the euphotic zone, and in the presence of nutrients, photosynthesis takes place.

Nearshore chlorophyll concentrations were generally high (greater than 1.0 $ug \cdot L^{-1}$) in 1977 and 1978 compared to middle shelf levels and the outer shelf in the absence of upwelling. High surface and bottom chlorophyll was always observed at stations within the 20 m isobath. River and estuarine sources of nutrients maintain a relatively high concentration of phytoplankton nearshore. The 1977 and 1978 data demonstrated little seasonality in phytoplankton biomass in the nearshore zone.

In summary, true seasonal cycles in phytoplankton biomass are not characteristic of the SAB. Chlorophyll is relatively high throughout the year in the nearshore zone. Chlorophyll concentrations of outer shelf waters increase dramatically in response to influxes of nutrient-rich deep water, but based on the available data, upwelling or intursion occurs more or less continuously throughout the year.

B. Biological Habitats

1. Coastal Zone

The coastal zone of the South Atlantic states may in general be considered to be made up of three types of ecosystems: sandy high energy beaches, estuaries, and wetlands. Two aspects of OCS oil and gas exploration and development activities are the most likely sources of potential impacts to the coastal areas: pipeline construction through these areas, and oil spills, either from the drilling or production facility or during transportation (by pipeline or by tankers or barges) to shore.

The following discusses these areas briefly and in the context of the aforementioned potential impacts. For a more comprehensive discussion, see the FEIS for Sale 43 and the references therein.

a. Beaches

The high energy beach is the predominant shoreline type, making up 1,575 km (978 mi) of the total ocean front of 1,918 km (1,191 mi).

Beach fronts and their associated dunes systems are highly dynamic areas. Winds continually reshape the dunes, and storms may radically alter the configuration of a beach area, particularly on a barrier island where passes may be filled in and new ones created by washovers. Beaches erode and accrete at very high rates, and man's construction activities, including those designed to protect a beach, often have unexpected results which only exacerbate the problem. The Department of Interior recognizes this and is considering new approaches to managing barrier islands and beaches, the most promising of which is to allow them to conform to natural forces without man's intervention.

For human beings, beaches provide the useful service of taking much of the impact of storms, especially that of waves and high tides, thus protecting lagoons, sounds, wetlands, and low ground behind them. Beaches also provide habitat, feeding areas, and nesting grounds for a wide variety of plants and animals, including several endangered species of turtles and a surprisingly large number of organisms which live literally in the beach in spaces between grains of sand. And, beaches provide recreation for large numbers of people.

Pipeline construction through beach areas probably has less adverse environmental impact than construction through other ecosystem types. While there is a good bit of local disturbance during construction and burial of the pipeline, the area rapidly returns to normal.

An oil spill reaching a beach area could cause a great deal of damage, killing intertidal and sand dwelling organisms as well as any birds and mammals that get heavily oiled. Clean-up operations are more or less successful, and tracts of oil on a heavily oiled beach may be present for quite sometime. Weathered oil is much less toxic and dangerous to organisms than fresh oil, however unsightly it may be. The oil spill analysis (Appendix D) indicates a low probability of an oil spill reaching a beach area, and that which does will probably have been at sea for several days and will have lost its volatile more toxic components. Therefore, the adverse impact to beaches from this proposed sale is not expected to be great.

b. Estuaries

Generally, estuaries are semi-enclosed bodies of water in which fresh water run-off meets and mixes with salt water of the ocean. The result is highly complex physically, chemically, and biologically, and there are many variations on the theme.

Estuaries which occur in this area include the mouths of: St. Lucie Canal, Indian and St. John's rivers in Florida; Satilla, Altamaha, Canoochia, Savannah, and Cumberland rivers, St. Catherines Sound and Ossabaw Sound in Georgia; the Broad, Combahee, Edisto, Cooper, and Pee Dee rivers and Port Royal Sound, St. Helena Sound, and Winyah Bay in South Carolina; and Cape Fear, New, White Oak, Neuse, Champan, and North Landing rivers, and the Pamlico Sound complex in North Carolina.

The image most people see when one says "estuary" is the medium salinity, moderate depth bay which has much fishing but not much visible evidence of anything else. The bay draws support from food webs of invisible microscopic plankton supporting the characteristic populations of crabs, fish, and commercial shrimp. Many of our largest estuaries are predominantly of this type althouth they are often fringed and bordered by smaller subsystems of other types. High nutrient levels and good stirring mechanisms generally produce high photosynthetic rates wherever clarity of water is maintained, although the rates are less than those found in systems like the marshes which have less water to absorb light.

In winter, with low light and well stirred waters due to tidal shifting and some turbidity from rivers, the plant cells spend too much time in the shade and stop making much food. In the spring, as light conditions increase, the critical condition at which the plant cells can make a net gain is reached and there is a sudden bloom of some of the diatoms that sets off the seasonal production sequence. During the winter, there is organic particulate food remaining from the previous season, from marshes, from rivers, and other storages that allows some of the animal life to persist.

With the rising burst of plankton growth, there are some releases of larvae from clams, oysters, and barnacles, and little water-flea-sized copepods develop. Reproductions and migrations of shrimp and fishes that eat the zooplankton are timed to coincide with the increased yields of these small components. The estuary has species with some ability in their kidney systems to deal with salinity fluctuation, some ability to switch food intake from organic matter to phytoplankton base, and an effective temporal program for migration and reproduction so as to time the need for more food to the appearance of more food.

Whereas the bottom clams and the special subsystems of the bay margins are contributors, the main system is one of plankton and plankton eaters. As the sunlight begins to decline after July, the population growth and reproduction declines and soon many populations migrate out again, decreasing their load on the system.

Estuaries often have partial stratification with wedges of dense salt water underneath. In systems allocated to this type, mixing is adequate to prevent anaerobic conditions from developing at the bottom even though oxygen is less there since respiration is higher at the bottom of the estuary than at the surface. Estuaries tend to be deeper as one goes north, but also the amount of tidal energy available for currents and mixing and eddy diffusion coefficients increase.

The markedly different oceanic biotas north and south of Cape Hatteras are not reflected in coastal systems behind the barrier islands. Shape and depth constitute the primary difference between Chesapeake Bay and the North Carolina Sounds. Shallow depth and dampened tidal effects promote good mixing. Water masses tend to be relatively turbid and move about in broad, gentle swirls rather than as part of a current. Patterns of water movement depend in large measure on wind direction and velocity. In reality, the sounds are shallow basins into which the estuaries empty. Lower levels of the food web in these sounds have been incompletely studied. In general, production is accomplished by diatoms and dinoflagellates. This energy moves up to the nekton level via copepods. Dominant nekton are of the characteristic "southern" types (e.g., bluefish, striped bass, flounder, mullet, and shad). Bluecrab *(Callinectes)* and menhaden *(Brevoortia)* are abundant and of considerable economic importance (Bellis, 1974).

North Carolina's sounds constitute the largest estuarine system along the Atlantic coast. Most of this vast system is of the medium salinity, (5-18 ppt) and plankton-based type and as such functions as a nursery or a temporary home for migrating nekton of commercial importance. Shrimp, striped bass, and menhaden do most of their "growing" during periods spent in the sounds or near shore coastal waters where they become the beneficiaries of a high level of phytoplankton production. In estuarine systems such as this, efficiency of energy transfer between plant and animal is greater than in most land environments. This is so because the producer com-

ponents of the food web are primarily diatoms. Diatoms convert some of their carbon intake to energy-rich (high calorie) fats and oils while most green plants store carbon as less rich carbohydrates.

South of Cape Fear, rivers such as the Pee Dee in South Carolina and the Savannah in Georgia empty into the sea via low marshland. Extension barrier islands, of the type responsible for formation of the North Carolina sounds, are absent or much reduced in importance. Consequently, estuaries along this portion of the Atlantic Coast have been described as a "muddy river mouth" type. Here the "middle-salinity-plankton-based" system consists of tidal channels through the salt marsh, major portions of the Charleston and Georgetown harbors, and a 16-19 km wide strip of "estuarine" water which remains trapped between high salinity ocean water and the beach. Sport fisheries, dependent at least in part on the middle estuary plankton, are similar to those of the North Carolina sounds. Commercial fisheries involve primarily oysters and blue crabs, both of which are directly dependent upon the plankton during one or more stages of their life cycle. Shrimp become of increasing importance southward along the Georgia coast.

Relatively few fish lead an entirely estuarine existence. Killifish (*Fundulus majalis*) appears to be the most abundant truly estuarine species in the Chesapeake region (McHugh, 1967). Other plankton-feeding herring-like fish move into the middle estuary only during a part of the year. The striped anchovy (*Anchoa hepsetus*) is abundant in Chesapeake Bay in the summer during which time its eggs are a common constituent of the plankton. Anchovies leave the bay during winter, and their position in the food web is occupied by the spotted hake (*Urophycis regius*).

A variety of fish, several of considerable commercial value, use the middle estuary as a spawning ground or nursery. The hogchoker (*Trinectes maculatus*), bay anchovy (*Anchoa mitchilli*) and silver perch (*Bairdiella chrysura*) are important inshore fish which spawn in Chesapeake Bay (McHugh, 1967). Other fish, spot (*Leiostomus xanthurus*), Atlantic croaker (*Micropogon undulatus*), and Atlantic menhaden (*Brevoortia tyrannus*) spawn offshore during colder months. Upon hatching, the young move rapidly into the estuary where they exhibit little growth until the return of warmer weather. Rapid growth occurs in summer as the young fish gradually move down the estuary and into more saline water.

The great majority of numerically or commercially important estuarine fish thus appear to be only summer residents of the middle estuary. Most explanations of fish migration involve correlations with seasonal "climate" patterns such as temperature, day length, breeding behavior, etc. However, the relationship of migration patterns to quantity and quality of food sources may be an equally important aspect of estuarine dynamics.

The degree of variability of the salinity regime is of great importance to species diversity. In highly variable estuaries there is low diversity, and the species are the highly adaptable generalities. As variability decreases, the fauna becomes more diverse, and number of habitat specialists increases. On the basis of the recent studies of macrobenthos distributions, the following general conclusions seem tenable (Darnell, 1979):

(1) Low salinity stress restricts the distribution of stenohaline species;

(2) Sediment composition and stability is important in determining distribution patterns, espcially in lower reaches of estuaries and embayments;

(3) Intertidal communities exhibit reduced species diversity, and they are dominated by opportunistic subtidal species;

(4) Macrobenthic communities may be predator controlled;

(5) Communities may be highly variable seasonally; and

(6) Large, deep burrowing species (bivalves, some polychaetes, and callianassid shrimp) are very important in relation to biomass and to sedimentary processes.

Estuarine seagrass beds are important in North Carolina and northern Florida, but they are sparse in the intervening area. Extensive studies are underway in North Carolina where the submerged vegetation covers 17% of the subtidal estuarine area and contributes 47-64% of the total annual primary production. Within such beds, inveterbrates are up to 40 times denser than on exposed flats, and they support a characteristic benthic fauna dominated by gastropods, bay scallops, and amphipods. They also provide refuge and feeding grounds for many species of juvenile fishes, crabs, and shrimp, and they annually export large quantities of detritus to other estuarine habitats. Only a few studies have dealt with benthic communities of the salt marshes. Some attention has been given to their relations with dredge spoils and with sedimentary and biogeochemical processes (Darnell, 1979).

Pipeline construction in estuaries may produce adverse impacts by resuspending a large volume of sediments as the pipeline is buried; the resulting increased turbidity would decrease productivity and could clog the gills of fish and invertebrates. If the sediments are contaminated with toxicants, resuspension might make the toxicants available to various organisms. In shallow areas, pipeline construction may alter water regime dynamics, possibly changing salt and fresh water interactions with far-ranging consequences. Choosing pipeline routes, should any be required to transport offshore oil and gas to shore, must be done carefully. The affected state will have the final say on such routing, and DOI has initiated planning and coordination among all interested government agencies.

Oil spills in an estuary can be a serious problem due to the shallow depth and restricted area. Such a spill would be difficult to clean up; in many cases, the clean up techniques might be more harmful to the biota of an estuary than the oil itself. Recovery from a large spill would probably take several years. However, the most likely source of oil in an estuary would be from a pipeline break in the estuary; this is highly unlikely, especially if pipelines are not permitted in the estuary. Oil reaching an estuary from an offshore spill is likewise unlikely. Thus, the probability of an adverse impact on an estuary as a result of this proposal is low.

c. Wetlands

Salt marshes are typically intertidal beds of rooted vegetation extending from somewhat above the low tide level to supratidal levels inundated only be extreme tides on low energy beaches. They occur along the margins of estuaries, gradually intergrading into fresh water marshes at upstream locations.

Behind the outer banks of the southeastern states, fringing the inner shores of the brackish sounds, irregularly flooded marshes occur. Here tidal amplitudes are very limited and often there are rather great changes in salinity of the ground and flooding water. In these marshes, the tidal amplitudes are usually less than a 0.3 m (1 ft.) and higher tides are wind-driven and are associated with storms and rapid changes of wind direction and velocity. In these marshes smooth cordgrass (*Spartina alterniflora*) seldom occurs in extensive stands and is generally found fringing the edge of rather straight tidal creeks.

From Cape Lookout, North Carolina, south to the Jacksonville, Florida area, the optimum development of salt marsh in the U.S. is found. These marshes, often called low marshes, form behind narrow barrier islands in areas influenced by heavy silt deposition from large rivers. There is a relatively small amount of open water behind the barrier islands. Tidal amplitudes are variable, ranging from 0.6-1.5 m (2-5 ft.) in North Carolina and northern Florida, to as much as 2.4 m (8 ft.) in Georgia and South Carolina. Although marshes throughout this entire region are similar, those from Cape Lookout to Myrtle Beach, South Carolina, are somewhat less extensive and well-developed than those from Myrtle Beach to Jacksonville. This latter area includes the famous Sea Islands of South Carolina and Georgia.

The characteristic feature of these marshes is the vast expanse of smooth cordgrass (*Spartina alterniflora*) which covers the soft, grey sediments between mean sea level and approximately mean high water. These broad, nearly level expanses of grass and soft sediment develop under the influence of high tidal amplitudes, dendritic creeks and deep tidal channels in vast number, giving the marshes a characteristic dissection pattern when viewed from the air. The slow, gentle subsidence of these South Atlantic marshes also contributes to formation of these intricate creek patterns.

Several distinct community types may be recognized within the South Atlantic salt marshes (Reed, 1947; Teal, 1962; Adams, 1963). Although these are reasonably well-defined and characterized by a clear combination of physiographic and biotic features, they actually grade into one another so that the marsh is in reality a series of communities which change gradually from the tidal creeks to higher ground.

Fresh water marshes occur primarily near the mouths of larger mainland streams and they may extend for some distance up rivers before being replaced by cypress-gum or hardwood swamps. Much of the area in the southeastern coastal plain now covered by fresh water marsh was cypress swamp before it was cleared and diked for rice culture. Shallow fresh water marshes contain a variety of species including cattails, several bulrushes, smartweeds, aneilema, arrowhead, arrow arum, and others. The deeper fresh water marshes are more extensive. In many areas this marsh type is comprised almost exclusively of giant cutgrass. Stands of sawgrass occur intermittently. Around the deeper margins of the marsh, stands of cattail are common and wild rice occurs in sporadic stands. In the deeper creeks and potholes, submersed and floating-leaved plants are dominant.

As salinities increase to brackish conditions (about 0.5-2 ppt), giant cutgrass is replaced primarily by big cordgrass and, to a lesser extent, by salt marsh bulrush.

Fresh water marshes basically consist of tidal fresh water and non-tidal fresh water. Tidal fresh water marshes are divided into two types based on shallow and deep water depths. The principal type of deep fresh water marsh in the coastal areas is the giant cutgrass marsh, which occurs along the larger streams that are subject to daily tidal effects. These marshes extend inland from the coast up the rivers for several miles in some instances. In general, vegetative species consist primarily of cattails, wildrice, pickerelweed, giant cutgrass and spatterdocks, often accompanied by pondweeds and other submerged growths in marsh openings. This marsh type is limited to South Carolina and Georgia in the South Atlantic region.

The shallow fresh water marshes are generally located along the larger streams in those portions which are also subject to daily tidal effects. Shallow fresh water marshes are distinguished from the deep fresh water marshes on the basis of their shallow water and vegetative composition (bid cordgrass, maidencane, sedges, rushes, etc.). These marshes occur predominantly in North Carolina in this analysis area.

The mangrove swamp ecosystem occurs sparsely along the U.S. southeast coast. Shaw and Fredine (1971) indicate a northern extremity in Florida of approximately 10,117 hectares (25,000 acres) in the Cape Canaveral area. The remaining mangrove in this region is restricted to the southern extremity of Florida. Three species of mangrove trees, red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*) dominate the mangrove communities; buttonwood (*Conocarpus erecta*), although not a true mangrove, is important in the transition zone between the swamp and upland vegetation.

Birds are abundant, conspicuous, and probably important in mangrove swamps. Approximately half of the species utilize the swamps for nesting activities and the others feed there or congregate there in large communal roosts. The food resources of the birds are varied. Many (egrets, herons, ibis, ducks, kingfishers, crab hawks, stilts, and pelicans) feed on estuarine fishes and invertebrates, and others (fly-catchers, woodpeckers, wrens, and black-birds) feed on seeds outside the swamps but return for roosting or nesting. The mangroves and their fruits, however, do not directly supply nutriment to birds, and their food supply, like that of the other animals, comes predominantly from marine life in the channels or on the mud flats. The dense nesting colonies in some areas may physically harm the trees, but the excreta is probably of some benefit.

Florida mangrove swamps also serve as nursery grounds for many animal species of economic importance—menhaden, black mullet, spotted sea trout, snook, tarpon, red drum, mangrove snapper, pompano, and pink shrimp. Edible oysters growing on the bottoms of shallow bays or on the margrove prop roots are also harvested in some areas.

These coastal wetlands and associated bodies of open water are very important to numerous species of waterfowl. Of particular importantce are the fresh water marshes, where most developments for the management of ducks are found. Undeveloped cutgrass marshes are used primarily during peak flights in the fall months. While the tidal rivers associated with the fresh water marshes offer little in the way of food organisms, they are nevertheless valuable in attracting waterfowl which utilize the adjacent fresh water ecosystem. The ecosystem is used most by the puddle ducks (mallards, teals, pintail, widgeons, etc.).

Other representative wildlife species include passerine birds, raccoons, rabbits, and small predators. In addition, several fresh water fish as well as some marine fish species utilize the fresh water marsh ecosystem.

In addition, a great variety of immature and mature fish and shellfish are found in the tidal creeks and shallow waters associated with the marsh. Mature oysters (*Crassostrea virginica*), clams (*Mercenaria mercenaria*), blue crabs, larval and mature shrimp of several species, and the juvenile and mature forms of many fish such as flounder, bluefish, menhaden, croaker, and tarpon are commonly found in the creeks.

Because of the importance of coastal wetlands as nursery grounds for many species important in commercial and sport fisheries; because coastal wetlands are highly diverse and productive ecosystems; because coastal wetlands can play a major role in reducing the impact of ocean derived storms on the adjoining uplands; and because coastal wetlands can be important natural waste treatment plants, utilizing the abundant nutrients which in other areas might be pollutants, any adverse impacts to them which affect these functions could have serious ramifications in many other areas. A major, and probably the most important, cause of wetlands is alteration of the area to provide for agriculture or urban development. Water related development also causes loss of wetlands.

The potential impacts to wetlands as a result of this proposed sale are similar to those to estuaries. A large oil spill in the wetlands could cause severe and long term damage, but the probability of this happening is very

small, partly due to the protected location of the wetlands. Pipelines through wetlands could cause considerable change by altering the fresh and salt water flow and regimes. Wetlands are probably the least desirable coastal location for pipelines. As mentioned above, an Intergovernmental Planning Program has been initiated by DOI to coordinate pipeline placement with the affected states and other interested agencies. Such a planning effort should serve to minimize environmental damage due to pipeline construction in the coastal zone.

2. Shelf

Darnell (1979) has recently summarized what is known about the biology of the South Atlantic OCS, and the following discussion is taken largely from that. For a more detailed description, see the FEIS for Sale 43 and Center for Natural Areas (1979), of which Darnell (1979) is a part.

A very brief description of the physical environment is necessary as background; the OCS of this area may be in three distinct zones, plus the Blake Plateau:

Cape Hatteras to Winyah Bay

Many patch reefs with heavy epifaunal growth occur within the bays, and algal reefs at the shelf break have been dated at 19,000-24,000 b.p. Although the sub-bottom stratigraphy is not well studied, several buried channels have been identified. Beach erosion is due largely to strong northeast storms. Sand and gravel are available in exploitable quantities, but there is no recent information on offshore phosphate, heavy minerals, or petroleum resources. The area is prone to earthquakes and slope slumping.

Winyah Bay to St. Johns River

Outcropping ledges and patches support heavy organic growth, and sand ridges are present. The sub-bottom exhibits buried irregular topography near the shelf break, and off the South Carolina coast tectonically active faults likely exist. Lower Cretaceous strata are believed to have the best hydrocarbon potential. Sand and gravel are present in economic quantities. The large Floridan Aquifer in Early Tertiary limestone extends offshore under the shelf, but due to heavy industrial use, it is being encroached by salt water. In Chatham County, Georgia, a large phosphate body exists onshore and offshore. This sub-zone is subject to considerable earthquake activity and possibly shifting deep-shelf sediments, especially during periods of heavy storm activity.

St. Johns River to Cape Canaveral

Rock outcrops with heavy organic growth occur off Cape Canaveral, and algal ledges are found along the outer shelf and upper slope. Linear shoals and terraces off Cape Canaveral probably represent Holocene marine transgression features. Sinkholes and other karst features in the cavernous Tertiary limestone are present but poorly known. Sub-bottom profiles identify tectonic ridges of Cretaceous strata under the mid-shelf off Jacksonville, and Miocene ridges under the shelf off Daytona Beach. Surface sediments, derived from Tertiary and Pleistocene deposits, are being actively reworked, and the finer fractions are being transported landward. Possible petroleum reservoirs exist in Jurassic and lower Cretaceous beds. Shelf sands provide an excellent potential source of beach fill, and the Floridan Aquifer extends beneath the shelf. Some phosphate deposits are known.

Blake Plateau

Coral mounds and ridges with greater than 100 m relief are known, and they are particularly numerous beneath the Gulf Stream. Some are currently active. Surface erosional features are known. The surface of the plateau is Miocene sediment overlain with a veneer of fine-grained carbonate Holocene sediment. This lies upon Upper Cretaceous and Early Cenozoic strata, probably mostly carbonates. Beneath these are the Lower Cretaceous beds, probably carbonate with some dolomite and evaporite interbedding. Conditions appear favorable for petroleum production, but water depths range around 1000 m. Phosphate deposits are known. Large areas of the surface are covered with manganese pavement and manganese modules. Vigorous erosion by the Gulf Stream occurs on the inner margin of the plateau, and slope-slumping, especially under storm conditions, is a possible hazard.

The waters and the bottom of the OCS provide habitat and food for a wide variety of organisms. Each general group is discussed briefly.

a. Phytoplankton

Recent phytoplankton studies have given primary attention to the estuaries and less to coastal streams and the shelf. Species composition, abundance, and seasonal patterns are fairly well known. In freshwaters the dominants are chlorophytes, in estuaries either dinoflagellates or diatoms, and on the shelf, diatoms. In estuaries dinoflagellates peak in late summer, and diatoms in the spring and fall. On the shelf over 600 species of phytoplankters are now known. In comparison with the cold waters above Cape Hatteras, the warm waters below the Cape show a greater diversity of diatoms and coccoliths and less seasonal fluctuations due, in part, to the stabilizing influence of the Gulf Stream. On the shelf productivity is greatest near shore, and it decreases further out. Special laboratory and field studies relate to nutrient requirements, pollution tolerance, and ground truth for satellite imagery. Additional work has been carried out correlating phytoplankton species and abundance with water masses and elucidating the roles of living and dead phytoplankton in food chains. Many phytoplankton collections are stored in various coastal laboratories.

b. Zooplankton

Zooplankton includes two groups, holoplankton (which passes its entire life history within the water column) and meroplankton (which passes only a portion of its life history, generally early developmental stages, in the water column). Both types are very abundant in the study areas. The taxonomy of the holoplankton has been fairly well straightened out, but the larval forms of many of the local species are still largely undescribed. Therefore, in many of the zooplankton studies of the area, meroplankton still can be identified to major group only.

Comparison of diveristy indices shows highest values at the ocean, lower through the estuary, and least at the upstream nursery areas. The presence of coastal species in estuaries tends to increase with increased flushing, due to up estuary transport in more saline bottom waters. Little recent work has been published on the distribution of shelf zooplankton except on the distribution of larval fishes. The distribution of pleuronectid larvae suggests spawning of this group north of Cape Hatteras, whereas bothids and cynoglossids apparently spawn in the warmer waters south of the Cape. Spawning seems highly correlated with water temperature and little correlated with salinity. The Gulf Stream has a very complex zooplankton community, but neither the Gulf Stream nor the Sargasso Sea has been well studied off the Cape Hatteras - Cape Canaveral area. Limited information suggests that the mean zooplankton standing crop is about 0.03 cc/m^3 and that of the Sargasso Sea about 0.02 cc/m^3. In the Gulf Stream copepods make up over half the standing crop, and chaetognaths 15-25 % (by volume). Siphonophones are also abundant, constituting 17.7% of the zooplankton volume. In comparison with neritic waters, the offshore areas have a larger component of carnivores and fewer obligate herbivores. Offshore the zooplankters utilize most of the phytoplankton standing crop and efficiently transfer the energy to higher trophic levels.

Factors underlying spatial and temporal zooplankton distribution patterns have been examined in some cases. Estuarine and nearshore species show great seasonality in spawning and larval abundance, but this seems to be less the case for the strictly offshore species. Certain estuarine species with good swimming capability seem to spawn well onto the shelf where current patterns can disperse the larvae widely along the coast. Others with little mobility spawn closer to shore where the larvae have a good chance of entering the adjacent estuary but limited chance of being swept to more distant estuaries. Zooplankton distribution within the estuary involves interaction between the local tidal dynamics and migratory behavior of the species. The timing of offshore spawning of menhaden appears to have evolved to coincide with peak Ekman transport of surface waters toward the coast. Thus, good and bad menhaden years may reflect the strength of this current or the degree of coincidence of the spawning with this event. Vertical migration plays and important role in the lives of certain estuarine and shelf species. In the estuary harpacticoid copepods are generally absent from the water column during the day, but they are very abundant there at night. They may also be stirred from the bottom by wind-driven currents, and during peak winds they may be twice as abundant as all other holoplankton groups combined. In the Gulf Stream copepods, pteropods, chaetognaths, and other groups are known to undergo diel vertical migrations.

Some recent work has been carried out in the region dealing with nutrient cycling and trophic relations. Urea may prove to be an important nitrogen source for phytoplankton, but has not yet been evaluated. Some carbon incorporation rates have been reported, and it is estimated that copepods utilize from 1-38% of the daily phytoplankton production. Nitrogen regeneration has also been studies on the shelf, and it has been shown to be far more important offshore than nearshore in terms of phytoplankton production. Nearshore nitrogen regeneration is quite low in relation to phytoplankton demand, and the excess is apparently supplied by benthic regeneration. Offshore, where the water column is greater, zooplankton regeneration apparently supplies the bulk of the nitrogen needs of the phytoplankton. Respiration and excretion studies of the gelatinous zooplankton in the Gulf Stream and Sargasso Sea show them to be extremely important in the metabolism of these systems. In general, herbivores exhibit high ratios of oxygen uptake: ammonia excretion (reflecting catabolism of carbohydrates and lipids). Carnivores exhibit low ratios (indicative of protein catabolism) or intermediate ratios (reflecting breakdown of proteins and lipids). Food preferences, feeding activity, and daily rations have been studied in several species of juvenile fishes.

Some studies have been carried out on thermal shock and synergistic effects of temperature, copper, and salinity on survival of fish larvae. Copper exposure lowers the thermal resistance, and chlorine exposure lowers survival rate at both ambient and elevated temperatures. Zooplankton entrainment by steam electric plants seem not to have a major effect on estuarine zooplankton populations. Water from dredge disposal sites and sediment extracts has been shown to be toxic to certain zooplankton species. Unworked zooplankton samples are present at a number of laboratories of the area, but most of the samples and associated data are currently being worked upon.

c. Neuston

The term neuston refers to those organisms which live all or part of their life in association with the surface of the water. The depth of the neuston layer is subject to debate, and sampling gear effective for one group of organisms may have different depth penetration from gear effective for other groups. The most generally accepted depth range of the neuston layer is the upper 5-10 cm.

On the shallow nearshore shelf of North Carolina it has been found that neustonic bacteria average 6.6×10^5 cells /ml. Of these, 80% were free living cocci, and 15% were rod-shaped cells, three fourths of which were found on particulate matter.

Extensive studies are underway to determine the seasonal and areal distribution of neustonic fish eggs, larvae, and juveniles over the shelf and slope of the region, and some of these results are already available. The reported catch includes representatives of 60 families belonging to 13 orders. Both tropical and temperate species are represented, showing the influence of the Florida Current. Warm temperate species were associated with the South Atlantic Bight shelf. Fair amounts of small tar balls and plastic particles are also routinely obtained in neuston samples. For example, tar lumps were present in quantities ranging from 0.7 to 96.9 mg/m^3, and they averaged over 20% of the wet weight of the neuston samples. The presence of tar balls before any oil and gas activity in the area suggests the presence of natural hydrocarbon seeps.

d. Marine Benthic Flora

At the present time, 352 species of marine benthic algae are known from the area of which 9% are blue greens, 51% reds, 16% browns, 3% goldens, and 21% greens. The algal flora is dominated by species of southern affinity, but some northern species are also present, especially in the vicinity of Cape Lookout. Probably none of the species are endemic. Most of the species are associated with marshes, estuarines, and nearshore marine substrates. Only one segment of the entire coast has been studied intensively, the stretch between Cape Lookout and New River Inlet, North Carolina. Recent studies have indicated a significant algal flora on offshore hard banks and rock outcrops, but this work is still in its infancy.

Recent studies have also begun in the laboratory to determine patterns of temperature and light favorable for the growth of individual species, and some work is underway on reproductive processes of several species.

e. Microbiology

Only a few studies have addressed the microbiology of the continental shelf. A transect off Cape Lookout, North Carolina, showed that in the water column the bacterial population was 19% greater offshore than inshore and that it accounted for 4-25% of the phytoplankton carbon. Free-living cocci accounted for 80% of the bacteria by number but only 40% of the carbon biomass. Bacilli (mostly associated with detritus particles) made up 60% of the bacterial carbon. Shelf sediment microbes (mostly *Pseudomonas* spp.) were found capable of degrading hydrocarbons when supplied with nitrate and phosphate. Ferromanganese nodules from the Blake Plateau were found to contain on their surfaces bacteria in concentrations of 6 x $10^5/cm^2$. Few or none were at the core of the nodules. The bacteria were mostly gram-positive cocci, and possibilities of contamination of the samples were precluded. Studies have been carried out on the effects of hydrostatic pressure on RNA synthesis in a bacillus isolated from the Blake Plateau nodules. This species can synthesize much better at high pressures than can the standard bacterium *E. coli.* It has been found that bacteria from deep sediments can decompose hydrocarbons at *in situ* temperature and pressure, but that they can accomplish the same ten times faster under normal laboratory conditions. Some biochemical studies have been carried out with deep sea isolates.

Several laboratory studies are of interest. A number of investigations have been carried out with a highly proteolytic bacterium isolated from the gut of the boring isopod, *Limnoria*, and isolates from shelf sediments have been found to produce and store unique phosholipids.

f. Benthos

Due largely to the presence of a few key investigators, the benthic communities of the South Atlantic area are among the better known in the world. This is due, not so much to the amount of descriptive survey work carried out in the area, as to thorough analytical analysis based upon careful sample design and critical taxonomic determinations. This work concerns both the macro-and meiobenthic components of the coastal systems.

Biogeographic affinities of the fauna are complex and not completely understood, but the following patterns seem to be emerging. The estuarine fauna south of Cape Hatteras is fairly similar to that north of the Cape, and the two together form a single Atlantic estuarine fauna. The fauna of the high salinity reaches of bays, estuaries, and outer beaches has more definite southern affinities, and few of the species in this group have established permanent populations north of Cape Hatteras. The offshore shelf benthos is even more southern, and on the Gulf Stream-influenced outer shelf it grades into a tropical fauna, especially in association with hard bottoms. Benthic biota of the slope, however, appears less affected by the Gulf Stream or the Hatteras barrier. Most slope species appear to range broadly north and south of the area in distributional bands marked by critical depth/temperature ranges. Since the isotherms dip southward, the depth distribution bands also deepen toward the south.

Habitat distribution of macro-benthic invertebrates has received recent attention, and it seems clear that salinity characteristics and substrate properties together account, in large measure, for observed distribution patterns. As elsewhere in the world, a faunal "breakpoint" seems to occur at a salinity of about 18%. In one major transect study from the river onto the shelf five major faunal habitats were recognized, as follows:

1) Freshwater (with fluctuating low salinity); clean, coarse sands; polychaete (*Scolecolepides*) and insect larvae.
2) Low salinity (stable, generally below 15%; muddy sands; bivalve (*Macoma*) and polychaete (*Heteromastis*).
3) High salinity (variable); muddy, coarse as well as fine, clean sands; bivalve (*Tellina*), polychaete (*Clymenella*), haustoriid amphipods, and pinnixid crab.
4) Shallow shelf; muddy sands; brittle stars.
5) Deeper shelf; relict, coarse sands; burrowing echinoids.

A number of recent studies have appeared concerning the dynamics of colonizing species on artificial substrates. Seasonal recruitment patterns include: spring-barnacles and hydroids, summer-bryozoans, and fall-barnacles and polychaetes. Studies on competitive interaction among colonizers support the conclusion that among the biofouling species succession leads not to a single climax, but to "multiple stable points" resulting in a general mosaic of semi-stable colonies.

Studies on oyster reefs reveal among the epifaunal species a successional sequence in which total community metabolism increases with time but in which weight-specific metabolism decreases. The biomass of such beds is dominated by oysters (70%). On a metabolic basis, however, the oysters account for 48.1%, other macrofauna-10.0%, microbiota-21.9%, and anaerobic chemical processes-20.0%. The oyster reef community is slow growing, persistent, and longlasting.

Few recent studies have been completed on the macrobenthos of the continental shelf. There is evidence that some species show rather regular seasonal fluctuations while others are more erratic in space and time. The offshore scallop beds in 20-25 m of water are associated with a unique benthic fauna, and the scallop populations seem to be controlled by predators (especially, the starfishes *Astropecten* and *Luidia*).

A great deal of recent work has appeared dealing with the meiobenthic fauna. These animals pass through sieves of 0.5 mm mesh size, but they are retained by 0.063 mesh sieves. This fauna is dominated by nematodes and copepods, but a number of other groups are found including gastrotrichs, kinorynchs, tardigrades, and others. These organisms are especially abundant in shallow water habitats. Most species require coarse sand substrate where the interstitial species predominate. Information is becoming available concerning seasonal population fluctuations, breeding seasons, nutrition, physiology, depth distribution and resource partitioning.

The distribution and abundance of meiofauna on the continental shelf has been examined by several workers. In general, the meiofauna is most dense on the inner shelf (13-15 m), but there is another peak density in deeper water. In one transect off North Carolina the depth/density relationship appeared as follows: 400 m-440/10 cm^2, 800 m-892/10 cm^2, 4000 m-74/10 cm^2. Down to 500 m nematodes dominate, but below that depth foraminiferans are more abundant, and these are especially important between 1000 and 2000 m. Nematodes reached greatest abundance on the inner shelf and copepods were most abundant in the coarser sands of the middle and outer shelf. A definite faunal break appears at a depth of 400-600 m of Cape Lookout and slightly deeper (500-750 m) further south, off Cape Fear. This break is associated with a shift in sediment types. Above the break the sediments are coarser, being made up of quartz and calcareous sands, whereas below the break the sediments are silty sands and clays. The water below the break is also colder, being less than 10^{o}C. Below 1000 m nematode species diversity was low, but that of benthic copepods was high.

Functionally, the benthos plays several important roles in the metabolism of coastal and marine systems. By mineralizing wastes and organic detritus, they provide nutrients for primary production. By packaging nutrients and energy into their own bodies, they support, in part, the higher trophic levels. In both cases they aid the microbes in regulating the rates of turnover of materials and energy in the marine biogeochemical cycles. Estuarine studies clearly show the importance of benthos as food for fishes, but few food studies have been carried out on the shelf species. Recent studies have also demonstrated the importance of benthic species in processing and ventilating bottom sediments. In estuaries bioturbation dominates sediment structure in all but the most physically active sedimentary environments, and in some cases the surface ½ cm may get reprocessed as much as four times per year. Such processes mix, ventilate, and irrigate the sediments and greatly facilitate chemical exchange between sediments and the water column. Recent studies have also demonstrated the rapid recruitment of opportunistic benthic species onto new bottoms created by dredging activities.

g. Nekton

Nekton includes the larger free-swimming aquatic animals. In the present context it has been taken to include all fishes as well as squids, scallops, shrimp, lobsters, and crabs. Planktonic larvae have been treated as zooplankton.

Since the region includes a wide variety of highly productive coastal habitats, there is a rich diversity of nektonic species. Some spend their lives in one habitat or another, but a great many pass different life history stages in different habitats and, therefore, must engage in seasonal migrations. Some of the marine species (such as the herrings, shad, striped bass, alewives, and Atlantic sturgeon) are anadromous and migrate upstream in the rivers to spawn. Others (such as penaeid shrimp, blue crab, and many fish species of which the sciaenids are predominant) spawn largely on the shelf, but are estuarine dependent and pass their juvenile stages there. Yet others spend their entire lives on the shelf but move inshore during the summer months and offshore during the winter. In addition to these migrators and year-around residents of particular habitats, the region is also visited by numerous species associated primarily with the Gulf Stream. Prominent among these are the large predatory billfishes, tunas, mackerels, wahoos, dolphins, and jackfishes.

Sampling of nekton presents enormous problems because of the diversity of sizes amd mobilities of the various pecies. The problem is further compounded by migratory tendencies of many species. Small-scale, moderately financed studies which are effective for plankton, neuston, and benthos, by-and-large cannot provide the same kinds of estimates of standing crop biomass and production rates for the nekton community. Information can be obtained concerning relative abundance in catches by a specific gear type and seasonal occurrence in one habitat or another, but each species presents specific problems which must be approached by specific techniques. Only recently under the MARMAP (Marine Resources Monitoring Assessment and Prediction) Program of the National Marine Fisheries Service and related programs has the kind of region-wide intensive sampling with appropriate gear been inititated to provide the data base necessary to estimate distribution, abundance, composition and biomass of the nektonic community and its component species. Therefore, the existing data base may be characterized as follows: largely qualitative in terms of the nektonic community, as such; semi-quantitative for certain groups (such as penaeid shrimp) which are readily sampled and of commercial value; and species and life-history oriented for those species of especial commercial and/or recreational interest. The remainder of the nekton discussion will focus upon the few generalities which can be drawn from the bewildering data base, and it will simply note those species for which a fair amount of life history information is available.

For the fishes, a great many papers have been published on faunal composition and species distribution. Among the fully marine species, efforts have been made to bring together all known information on the larger migratory and other commercially important species such as the white and blue marlins, sailfish, swordfish, tilefish, bluefish, menhaden, snappers, and groupers. Trawl surveys have provided catch statistics concerning distribution and relative abundance of demersal species, and beach seines have provided data on the surf catch. For the permanent residents and seasonal transients which utilize estuaries of the region, the general patterns of distribution, habitat utilization, and seasonal occupancy are now known, at least in a general way. However, the environmental factors which govern their activities and which determine annual abundance are poorly known.

For the invertebrates most of our knowledge of composition and seasonal abundance relates to commercially important species. About 95% of the offshore catch is made up of brown and white shrimp, and the remainder includes royal red, pink, and rock shrimp. American lobsters, which are occasionally caught north of Cape Hatteras, do not enter warmer waters south of the Cape. A large population of rock shrimp inhabits the shelf off Cape Canaveral. A large fraction of the commercial shrimp catch comes from the open bays and sounds, and the Pamlico Sound catch represents about half the North Carolina shrimp landings. White shrimp predominate, although large quantities of brown shrimp are also taken. A number of species of squids are known from the shelf, and limited information is available concerning their distribution in terms of depth and temperature.

A small amount of information is available concerning relative biomass of fish species in trawl catches. In a survey from Cape Fear, North Carolina to Cape Canaveral, Florida, the catch over four seasons ranked as follows: roughtail stingray-45.5%, porgies (*Stenotomus* spp.)-15.7%, bullnose ray-6.0%, and orange filefish-5.5%. All other species were less than 5.0% each. Relative biomass estimates from trawl surveys in South Carolina estuaries include: star drum-19.3%, Atlantic croaker-17.4%, spot-10.4%, white catfish-9.9%, silver perch-8.0%, and weakfish-5.7%. All other species made up less than 5.0% each. A total of 88 species was taken.

Various types of migration patterns are known, and some of these are under study. Larger Gulf Stream species annually migrate from the tropics to Canada and back, and they may circle the north Atlantic. Other species show major seasonal migrations along the coast (some going from Florida to Long Island). Many show shorter latitudinal migrations, and a great may exhibit onshore-offshore movements. Such migrations are often associated with specific life history stage, feeding and spawning.

Some studies are being carried out to determine environmental factors associated with normal habitats and life history activities. Among the factors which seem to be important to some species are current pattern, temperature, salinity, and dissolved oxygen. A number of studies have addressed food and feeding relations, nutritional requirements, and caloric intake. Studies on response to human influence include investigations on power plant siting and operation, accumulation and response to pesticides and heavy metals, impact of dredging, and competition with exotic species.

h. Live Bottom and Reef Areas

Live bottom areas are defined as those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozonas, for corals living upon and

attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography, or whose lithotope favors the accumulation of turtles, fishes, and other fauna. These areas have been considered to be sufficiently unique and sensitive to require protection from the possible deleterious effects of oil and gas drilling operations. In general, the South Atlantic area live bottoms are small scattered areas of broken relief offering a hard substrate for benthic organisms, but in some cases may be smooth with a thin veneer of sand covering. The broken relief areas seem to harbor greater numbers of organisms than the smooth areas. The locations of such areas are not known with the precision necessary to afford them protection from oil and gas exploration and development activities; therefore, the stipulation described in Section I.C.2.b. was developed to ensure that such areas, if any are present, within each leased block are located prior to beginning any activity which might damage them, and that appropriate restrictions are placed on the lessee to protect these areas.

The following brief discussion of live bottom areas is taken from Continental Shelf Associates (1979): "Hard bottom areas may either outcrop on the seafloor or be covered by a veneer of sand of variable thickness. Rocky outcrops are probably always covered with epifauna and have an associated fish population (live bottoms) though the quantity and quality may be quite variable. The hard bottoms that are covered by a veneer of sand may also support a variable biomass and number of species depending on the thickness of the sand layer. If the sand layer is too thick the area would not support an attached epifauna (barren sandy bottom), but if the layer is thin, a relatively large number of attached biota and fish may be present (live sandy bottom).

"There are a number of reports of hard bottoms, live bottoms, patch reefs, black rocks, fishing banks, snapper banks, limestone reefs, and algal reefs occurring on the continental shelf between Cape Hatteras, North Carolina and Cape Canaveral, Florida, but very few of the investigations have included sufficient sampling to fully characterize the areas. The hard bottoms have been described in terms of inner, middle and outer banks." (Complete references and a more detailed description may be found in Continental Shelf Associates 1979 and in the FEIS for Sale 43.)

The inner shelf live bottoms are reported lie between Jacksonville, Florida and Charleston, South Carolina in water depths of approximately 15-25 m. In a study involving an inner shelf hard bottom area, Hunt (1974) investigated an area of approximately 41 square kilometers in about 20 m of water located 33 km (18 nmi) east of Sapelo Island, Georgia. The study site was previously known as "Sapelo Reef," but was re-named "Gray's Reef" by Hunt. The site was studied using a recording fathometer, side scan sonar, subbottom profiler, and underwater television. Samples were collected with dredges and additional samples were collected and observations made during 11 SCUBA dives. The exposed reef areas were described as an interfingering series of northeast-southwest trending ridges and troughs. The rock outcrops, which did not exceed 6.6 m in relief, had a discontinuous distribution and sand ranging in thickness from a few to 30 or more centimeters covered some of the low relief rock areas. Shallow hard bottom areas (4-17 m) have been reported less than 10 nmi offshore of New River Inlet (Onslow Bay), North Carolina and Little River (Long Bay), South Carolina. The investigated hard bottom areas ("Black Rocks") were composed of a base of Trent Marl with *Vermicularia spirata* (gastropod) and tubiculous polychaetes forming a reefal cap. A hard bottom area in 16-24 m of water has been reported off Charleston, South Carolina. The bottom was described as generally being flat sand underlain at varying depths by rock which occasionally protruded as rocky patches or low ledges of up to 30 cm relief. The rock was a tightly cemented limestone conglomerate of carbonate shell and quartz-sand material. Additional references to hard bottom areas in the nearshore zone include: (1) lithified to semi-consolidated rocks in 18 m of water off Georgia ("Gray's Reef"); (2) conglomerate rock ("coquina") located in 10-18 m of water off Cape Lookout, North Carolina; (3) Pleistocene outcroppings in Onslow Bay, North Carolina; (4) an outcrop of rock with 5 m of relief in 23 m of water; (5) major coral patches in 19-40 m of water in Onslow Bay, North Carolina; and (6) a well defined system of rocky ledges lying in 20-30 m of water off the east coast of central Florida.

The middle shelf hard bottom areas are thought to extend from Jacksonville, Florida into Onslow Bay, North Carolina, in depths of 30-40 m. Rock outcrops with up to 7 m of relief in 45-55 m of water off the central east coast of Florida have been reported. A major outcrop area of phosphatic limestone is believed to extend from off Cape Fear to Cape Lookout (Onslow Bay), North Carolina, based on lithoclasts from sediment samples. The sediment cover over consolidated Miocene sediments in Raleigh (North Carolina) and Long Bays (South Carolina) is relatively thick with few outcrops occurring in contrast to Onslow Bay. Hard bottom areas are present off Charleston, South Carolina, in 27 m and 37 m of water and possibly off Jacksonville, Florida, in 26 m of water based on biota collected in trawls. Three types of hard bottom have been described: the morphotypes

were (1) low-relief hardgrounds, (2) moderate-relief reefs, and (3) shelf-edge reefs. The low-relief hardgrounds were described as having less than 0.5 m of relief which made them susceptible to covering by a thin veneer of sand. They were generally undetectable on fathometer records and were often difficult to identify from sonograms alone, but when sonograms and 3.5 kHz profiles were examined together the hardgrounds were more discernable. Features with relief between one-half and two meters or more were termed moderate-relief reefs. They too were said to be difficult to identify on fathometer records alone though they were more easily recognized on sonograms when used in conjunction with 3.5 kHz profiles than the low relief features. The shelf edge reefs were normally identifiable on fathometer, side scan and subbottom records. The density of hard bottom areas appears to be the lowest off the central coast of Georgia as compared to northern Florida and South Carolina. A hard bottom area in 29-32 m of water off Charleston, South Carolina, has been described. The substrate is composed of sand with rock patches and low relief ledges protruding through the sand, The sampled rock is a limestone conglomerate of carbonate shell and quartz sand. A television camera was used to view 128 randomly selected stations in water depths ranging from 27-183 m between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Live bottom (hard bottom) based on the observations was estimated to comprise 23.3% of the shelf while live bottom with more than 1 m of relief was estimated to cover approximately 7.4% of the shelf which was in the range (3-10%) of other estimates mentioned in the paper. The occurrence of the discontinuous inner and middle shelf hard bottoms appears to be primarily related to acoustically reflective hard layer(s) which outcrop in erosional or non-depositional areas. A greater thickness of surficial sediments probably covers the inner shelf layer, which may be similar in size and lithology to the "Gray's Reef" substrate, resulting in a smaller amount of hard bottom than that in middle shelf areas.

The outer shelf banks or reefs are a discontinuous series of ridges and ledges in 50-80 m of water that parallel the shelf break and are found from Cape Hatteras, North Carolina to Cape Canaveral, Florida. Shelf-edge prominences which vary in morphology, organic composition, distance from shore, and water depth are also found from Cape Canaveral to Key West, Florida, in depths from 70-110 m. Several shelf-edge (rock) ledges with reliefs of 5-10 m have been found off Georgia. A discontinuous algal reef approximately 150 km (80 nmi) in length that was located in 80-110 m of water and parallel to, though slightly seaward of, the shelf break has been reported off North Carolina. Two distinct types of rock were dredged from the reef: (1) algal rock that included "lithothamnion balls" (coralline algal nodules formed principally by *Lithothamnium*) and consisted of a framework of calcareous algae and lesser amounts of bryozoans and worm tubes, and (2) conquina rock. A series of terraces have been described at various depths on the shelf between Cape Lookout, North Carolina and Miami, Florida. The terraces, which showed little correlation to the shelf edge, were the result of lowered stands of sea level. The shelf edge from Cape Hatteras, North Carolina to Miami, Florida, have a discontinuous series of low relief (less than 10 m) ridges, perhaps of algal origin. Lithified to semi-consolidated rocks up to 1 m in diameter and encrusted with calcareous growth and partially covered by sand-size material have been observed in 50-70 m depths. Four ridges with relief of up to 10 m and intervening sediment filled troughs have been described on the outer continental shelf off Cape Hatteras, North Carolina. Troughs, terraces, and poorly defined ridges parallel to the shelf break (50-80 m) have been described at depths of 50-150 m between Cape Hatteras and Cape Fear, North Carolina. The shelf-edge topography from Cape Fear, North Carolina to Cape Canaveral, Florida, was described as mainly smooth and undulating with a generally indistinct shelf break. Ledges with 6-10 m of relief and rises with less than 5 m were occasionally noted at depths of 50-70 m while terraces were seen in 70-110 m of water. Dredge samples indicated that the veneer of the rock outcrops along the shelf break were composed of algal limestone, quartz-rich calcarenite, and calcareous quartz sandstone. South of Cape Canaveral the shelf break was reported to be significantly shallower with ridges and ledges continuing. The shelf-edge features between Cape Hatteras, North Carolina and Cape Canaveral, Florida, appear to be primarily algal ridges that were formed by relict calcareous sources deposited during lower stands of sea level and mainly during the Holocene transgression. The coralline algal limestones and calcareous sandstones which were dredged from certain shelf-edge features are believed to have formed a veneer over buried pre-Holocene Gulf Stream erosional surfaces. The features were not the result of unique constructional processes but were present primarily because they existed in areas of low depostion and were therefore not buried under recent sediments. The structure of many shelf-edge features in southern Florida and the Gulf of Mexico also seems to be related to the Holocene transgression. However, other shelf-edge banks in the Gulf of Mexico have resulted from vertical salt intrusions.

The benthic organsims of these areas are in large measure the reason for concern for live bottoms. These organisms are sessile and provide food and habitat for larger pelagic animals important to commercial and sports

fisheries. Some organisms, such as corals and coralline algae, are active reef builders. The following brief description of the benthic biota is again largely from Continental Shelf Associates (1979):

"A hard bottom area ("Black Rocks") in 4-7 m of water is located less than 18.5 km (10 nmi) off New River Inlet, North Carolina and Little River, South Carolina. Over 400 faunal species were recorded from the hard bottom of which 74% were described as southern ranging species. The taxa which showed the most predominant southern affinities were sponges, ascidians, bryozoans, decapods, polychaetes, mollusks, amphipods, and echinoderms. The faunal community associated with the coral *Oculina arbuscula*, is only known from Cape Hatteras, North Carolina to Charleston, South Carolina, in depths of 3-25 m. Coral heads were collected from three jetty areas (Cape Lookout, Beaufort, and Charleston) and from water depths of 10-18 m off Cape Lookout, North Carolina. *Telesto fruticulosa*, *Titanideum frauenfeldii* (octocorals), and *Trachygellius cinachyra* (sponge) were also found off Cape Lookout. Hunt (1974) reported that soft corals, sponges, ascidians, bryozoans, barnacles, and algae were the predominant epifauna on "Gray's Reef" located in 20 m of water off Sapelo Island, Georgia. Two species of ascidians, 5 species of sponges, and 6 species of anthozoans were identified. Areas of abundant growth were said to be associated with exposed rock, moderate growth with rock thinly covered by sand, and sparse growth with rock covered by up to 30 cm of sand.

On the rock outcrops of Onslow Bay in 20-40 m of water there exist two species of hermatypic corals (*Solenastrea hyades* and *Siderastrea siderea*). Specimens of *Solenastrea hyades* were reported to be quite healthy despite exposure to water temperatures as low as 10.6^{o}C and probable high turbidity while specimens of *Siderastrea siderea* were generally in poor condition. Four species of hermatypic corals have also been reported from Onslow Bay and include *Astrangia astreiformis*, *Ballanophyllia floridana*, *Oculina arbuscula*, and *Phyllangia americana.* Coral heads, sea fans, algae, and sponges characterized the "coral patches". The majority of the algae off Onslow Bay is believed to have centers of distribution for the western Atlantic in the Caribbean Sea. Sixty-six percent of the offshore species were said to reach their northern limit of distribution in Onslow Bay and 33% were said to be found both north and south. Sixty species of invertebrates have been collected with an otter trawl from two hard bottom areas off Charleston, South Carolina, in 27-37 m of water. Although soft corals, sponges, and ascidians were mentioned in addition to *Oculina* sp., no species list was available at the time of this writing. Three hard bottom areas in 16-24, 29-32, and 32-37 m of water off Charleston, South Carolina, have been described. Attached epifauna were observed in the two shallower areas (no visual observations were made in the third area) even when up to 8 cm of sand covered an underlying rock layer. The epifaunal assemblage in the observed areas was reported to be dominated by sponges and soft corals with algae and hard corals occasionally present. Five species of sponges, three octocorals, and two scleractinian corals were identified from the two shallower areas.

Approximately 170 species of invertebrates (107 species identified) were collected with a small biological trawl in the vicinity of an "algal reef" in 80-110 m of water off Onslow Bay, North Carolina. Three trawl stations were located on the reef, one shoreward of the reef, and one seaward of the reef. Seventy-six precent of the identified fauna were collected from the reef stations with mollusks (45 species) and anthropods (34 species) numerically dominating the samples. Ninety-one percent of the identified taxa were considered to have northern ranges. The coral Oculina is present on shelf-edge features off north Florida, and the shelf-edge fauna off Sebastian and St. Lucie Inlets, Florida, is a coral (*Oculina varicosa*) - bivalve (*Barbatia candida*) - echinoderm (*Ophiothrix angulata*) assemblage. Eight taxa of anthozoans, 32 of decapods, 8 of echinoderms 16 of (living) mollusks, and 26 of bryozoans were identified from dredge samples.

Many of the studies involving the hard bottom associated invertebrates have reported that the majority of the epifauna is derived from more tropical waters. It has been suggested that the tropical species are introduced by the northern flowing Gulf Stream. Although it appears that a large percent of tropical species can survive as far north and inshore as Onslow Bay, North Carolina, with the spatial extent of the assemblages dependent on the availability of a hard substrate, the reproduction of the various tropical species at the northern edge of their range has not been investigated. Thus, the soft bottom shelf fauna from Cape Hatteras to Cape Canaveral appears to be mainly Carolinian while the hard bottom fauna is primarily Tropical.

The importance of live bottom areas as habitat for commercial fishes is well documented. Struhsaker (1969) reported the results of a five year study of demersal fish resources on the southeastern U.S. continental shelf between Cape Hatteras, North Carolina and Jupiter, Florida, in which 956 exploratory trawling stations were occupied between depths of 11-183 m. The continental shelf was divided into five regions based on the results of the study: (1) coastal (15-18 m); (2) open shelf (18-55 m); (3) live bottom; (4) shelf edge (55-110 m);

and (5) lower shelf (110-183 m). The live bottom habitat, which was said to consist of outcrops of rock that were heavily encrusted with such sessile invertebrates as sponges and sea fans was found within the open-shelf habitat and seemed to be more numerous off northeast Florida and South Carolina. Moderate to large catches of snappers (*Lutjanus* and *Rhomboplites*), groupers (*Epinephelus* and *Mycteroperca*), and porgies, (*Calamus* and *Pagrus*), as well as other subtropical and tropical species of fish, were taken from the live-bottom habitat. The shelf-edge habitat, though sometimes difficult to trawl because of the relief, was found to contain coral, sponge, and other predominately tropical invertebrate animals in addition to large concentrations of snappers, groupers, and porgies in certain localities. The trawl catches in the open-shelf zone were generally poor with the live-bottom and shelf-edge habitats being more productive.

Stetson et al. (1962) have described living deep-water coral reefs on the Blake Plateau some 165 miles southeast of Charleston, South Carolina. Since no tracts of this proposed sale are anywhere near this area, it will not be discussed further.

Ayers and Pilkey (unpublished manuscript) have described coral areas on the Blake Plateau on which tracts 162-174 (all 13 of the tracts offered in the Stetson Meso lease area) are located. Water depths range from 475-600 m. Little is known about specific locations of individual areas of living coral, and the Ayers and Pilkey study used bottom profiles to make judgments regarding the presence of coral reefs; many of these may be relict reefal outcrops rather than presently living reefs. Nevertheless, it is clear that living deepwater corals do exist in this area; thus the following, taken largely from Ayers and Pilkey, is of interest: *Lophelia prolifera* and *Enallopsammia profunda* are the only two species of colonial coral recovered from the plateau. In addition to the colonial species of coral, the solitary species *Bathypsammia fallosocialas*, *Thecopsammia socialis*, *Bathypsammia tintinna balus*, and *Concentrotheca laevigata* were also identified in subsamples from the plateau. Not all corals on the plateau were associated with coral banks. Many living corals were recovered from the northern end of the study area attached to large phosphorite gravels and pavements.

Piston cores that were recovered from the coral banks give us some idea of the bank stratigraphy. The coral banks are composed of thick sequences (1-3 m) of coral gravels floating in a matrix of yellowish and greenish gray muds and muddy sands. Hydrotoilite was noted in a few of the cores from the banks. Most of the recovered bank sediments were unstructured.

The framework of the banks are the two species of ahermatypic and colonial coral. Coral banks occur on the plateau primarily in linear groups although isolated banks were also observed. In Stetson's study area the individual banks average 0.5 miles in diameter and occur in groups of 200 or more. The largest bank described by Stetson et al. (1962) is 480 feet high. Banks on the inner plateau described by Ayers and Pilkey are of lower relief, the highest being 300 feet. However, the areal extent of the group of banks on the inner plateau is much larger.

Factors controlling the distribution of these deepwater corals are not well known. It is likely, however, that at least the three factors influence the location of coral banks on the Blake Plateau. The optimum water temperature for deep-water corals varies but is always below the thermocline. Near bottom water temperatures at sites on the Blake Plateau where living corals were collected range from 6.0-12.0^{o}C. Stetson et al. (1962) report bottom water temperatures near the coral banks that range from 7-10^{o}C. Strong bottom currents are also needed to: (1) supply the coral with plankton; (2) keep the polyps clean of fine sediments; (3) help remove metabolic wastes; and (4) help provoke the growth and distribution of the coral banks. Finally, there must be a clean hard surface where the coral larvae and living coral branches that are broken off the main colony can attach and grow. Stetson et al. (1962) suggest the attachment surfaces on the Blake Plateau are outcropping lithified carbonate rocks. Evidence here suggests that on the inner plateau the attachment surface is typically the surficial cover of Miocene phosphorite gravels and pavements. Phosphorite gravels and pavements recovered from the plateau often have solitary and colonial corals attached. These gravels and pavements act as "hardgrounds" like those found on the shelf, serving as an attachment surface not only for the corals but also for bryozoans, sponges, and worms.

A scenario is suggested by Ayers and Pilkey that would explain the dramatic difference in the relief of the coral banks on the inner plateau that were described by them and those banks described further seaward by Stetson et al. (1962). The banks described by Stetson et al. were located beneath a former course of the Gulf Stream while the banks described by Ayers and Pilkey lie beneath the present course of the Gulf Stream. The meandering flow of the Gulf Stream periodically crosses the coral banks causing the breakdown of the colonial corals. In this manner the frequency with which the Gulf Stream meanders across the banks controls the height of the banks. The banks studies by Stetson et al. (1962) are no longer subjected to the strong Gulf Stream bottom

currents and can therefore grow to much greater heights. Radiocarbon dates of colonial corals from the plateau indicate the corals have existed on the inner plateau at least since Late Pleistocene time.

The other coral reef areas of concern, Gray's Reef and the Onslow Bay coral areas, are far removed from any of the tracts in the proposed sale.

The most serious potential impact ot the shelf biota described above is considered to be the direct mechanical damage to benthic communities that could be caused by drilling rig and platform placement, anchors, and pipeline emplacement. The stipulation discussed in Section I.B.2.b. is designed to prevent such potential damage, and in addition pipeline routes will be carefully chosen to have a minimal impact on live bottom areas.

The potential impacts from oil spills will be largely confined to the upper few meters of the water column and would not affect benthic communities expert in shallow near-shore areas which are unlikely to be reached except by oil which has been weathered and is thus less toxic. The plankton entrapped by oil will be severely damaged, perhaps even totally killed, but unless the spill is a massive one it is unlikely that a significant fraction of any species or community, or even year group (in the case of eggs and larvae) would be affected. This small impact would be limited to the area of "fresh" oil which forms slicks, since weathered oil, besides becoming less toxic, tends to form discrete clumps and so would not cover the entire water surface of the area.

Thus, it is concluded that the impacts to shelf biota of this proposed sale will, even under worst case conditions, be minor and extremely localized, to the point of being insignificant in ecosystem terms, provided that the proposed stipulation (Section I.B.2.b.) is imposed.

3. Slope and Deep Oceanic

Little recent information has been published on the benthos of the slope or the deep ocean off the South Atlantic states. Species appear to be distributed in narrow bands which are depressed southward following isotherms. The fauna of the steeper deeper slope (1,200-3,000 m) is similar to that of the slope of southern New England. Around 2,000 m the zonation seems to be affected by the Western Boundary Undercurrent. The very deep slope fauna is similar all along the east coast and Gulf coast (Darnell, 1979). It is quite probable that deep water corals, similar to those described in Section III.B.2. above, are present throughout the area, especially on the upper reaches of the slope in water depths of 200-600 m in areas of high relief. Thus, deep water corals are likely to be found in tracts 1-39 (all the tracts in the Currituck Sound, Manteo, and Russell lease area). Should this be true, the stipulation of Section I.B.2.b. will serve to identify such areas and allow protective restrictions to be imposed.

The biota of the water column over the slope and the deeper basins should be similar to shelf water, but with a much lower biomass and a much reduced diversity. For reasons similar to those given in Section III.B.2. above for shelf water biota, the potential impacts from this proposed sale on these slope and deeper water column biota is believed to be negligible.

C. Selected Socio-Economic Characteristics

1. Economic Conditions and Trends

The South Atlantic coastal region from Cape Hatteras to Cape Canaveral has experienced relatively little industrial development in the past. Historically, the economy of this area has lagged behind that of the nation as a whole during the transition from an agrarian to an urban-industrialized economy.

During the 1960's economic growth was so slow that population declined in 30% of the counties, and net out-migration occurred in two-thirds of the counties. Poverty rates were high and per capita income was low in the rural and other areas of low economic growth.

Major coastal development activity has centered around ports and tourism. Historically, port activity has provided the major focus for coastal development activity. The region's major urban and economic centers are located around the natural harbors of Wilmington, Charleston, Savannah, and Jacksonville with less activity occurring at the ports of Morehead City, Brunswick, and Canaveral Harbor.

More recently the region's economy has greatly improved. Growth in tourism, port activities, commercial fishing, pulp, paper and chemical production, and government employment has contributed to the regional economy.

A more detailed discussion of the economic conditions and trends (including employment and population) in the South Atlantic coastal region is presented on a state by state basis in the FEIS for OCS Sale 43.

2. Land Use

The South Atlantic region contains a wide variety of land uses ranging from highly urbanized areas to sparsely populated uplands and inaccessible swamps and marshes. Forests and wetlands (swamps, marshes, and barrier islands) make up the characteristic pattern and predominant classification accounting for well over 80% of the total land area in most portions of the region. Farm land is an important land use in many sections of the region even though the amount of land in such use has been on the decline. Major urban areas along the coast include: Morehead City, Jacksonville, and Wilmington, North Carolina; Myrtle Beach, Georgetown, and Charleston, South Carolina; Savannah and Brunswick, Georgia; and Jacksonville, St. Augustine, Daytona Beach, Titusville, and Cocoa, Florida. Numerous other urban places, small towns, and rural settlements are scattered along the coast. Most residential, commercial, manufacturing, public, and semi-public uses are located within or adjacent to the region's urban areas and small towns. Considerable rural non-farm residential development is scattered along the region's roads and highways. Numerous conservation and recreation areas, and historic sites are found in the region including: national seashore areas; state, county, and city parks; wildlife refuges and management areas; national forests, landmarks, and historic sites; and recreational beaches.

A detailed discussion of land use of the South Atlantic coastal region is included in the FEIS for OCS Sale 43.

3. Oil and Gas Industry

There is negligible production of petroleum and petrochemical products in the 30 county South Atlantic coastal area, and in the entire four state area.

Petroleum consumption in the four state area was estimated at 1.173×10^6 barrels per day in 1973, which is equivalent to the output of about 5 refineries of 250,000 barrels each. Projections indicate this demand could grow to the equivalent of 7 of these refineries by 1985 (VIMS, 1974).

At the present time, a number of proposals for refineries are being considered including: a 50,000 barrel-a-day refinery in Savannah; a 150,000 barrel-a-day refinery in Wilmington; a 30,000 barrel-a-day refinery in Morehead City, as well as refineries at locations in Georgetown and Jasper Counties, South Carolina. However, these tentative proposals are still in the planning and regulatory review stage so that their actual development, including their capacity and final location, is undecided.

A more detailed discussion of the oil and gas industry in the four state South Atlantic region is presented in the FEIS for OCS Sale 43.

4. Port Facilities

There are seven major commercial ports within the South Atlantic region. The three smallest of these are located at Morehead City, North Carolina; Georgetown, South Carolina; and Brunswick, Georgia. The other four, which have oil storage facilities in excess of five million barrels, are located in Wilmington, North Carolina; Charleston, South Carolina; Savannah, Georgia; and Jacksonville, Florida. The larger of these ports are served by 11.6-12 m depth (38-40 ft.) channels and the smaller by channels of 10.6 m (35 ft.) or less. All seven ports are served by the Atlantic Intracoastal Waterway.

As previously discussed, these ports have historically been the focus of economic activity and population growth in the South Atlantic coastal region. At present, these ports are also the regions of largest urban areas and most important centers of manufacturing and commerce.

Additional information on the facilities and conditions in these reports is contained in the FEIS for OCS Sale 43; VIMS, 1974; and CNA, 1979.

5. Commercial Fisheries

Commercial fisheries in the South Atlantic have over the years provided about 6% of the nation's fisheries in terms of weight and value (table III-1). The distribution of major pelagic and demersal fisheries in the area are shown in visuals 4 and 5.

During the six year period, 1971-1976, the mean annual catch for the four South Atlantic states was 288 million pounds valued (ex-vessel) at $55 million. North Carolina was the leading state accounting for 32% of the mean annual value and 65% of the weight landed, followed by the Florida east coast comprising 30% of the value and 22% of the weight. South Carolina contributed 20% of the value and 7% of the weight, and Georgia, 18% of the value and 6% of the weight (table III-2).

The major fishing ports in each of the South Atlantic states are listed in table III-3. In North Carolina, Wanchese, Wrightsville Beach, and Carolina Beach are the most important ports for oceanic species in terms of value landed. Pamlico, Hobucken, and Belhaven are the most important North Carolina ports for value of estuarine species landed. In South Carolina most of the landings are in the central district, especially oceanic species.

Employment in the fishing industry is shown in table III-4. There are approximately nine to ten thousand commercial fishermen in the four states and 5,500 to 6,000 persons are employed in the processing and wholesale sectors. For years subsequent to 1976, these employment figures can be expected to increase with the implementation of the Fisheries Conservation and Management Act (FCMA).

The data from Chestnut and Davis (1975) show that in North Carolina the number of commercial fishermen peaked in 1902 with 14,755 reported, then gradually declined to around 4,000 in the late sixties. During the seventies the number of fishermen has shown an upward trend, and in 1976 nearly 5,000 were employed in North Carolina.

The number of vessels (5 tons or larger) in the South Atlantic fishery was reported as 1,421 in 1976, an increase of 97 vessels over the 1971 level. The number of motor boats increased by nearly 900 to 5,752 boats during the same period. New vessel construction for the fishing fleet was reported at 127 vessels in 1977 for the South Atlantic. Nearly all these vessels are less than 70 feet in length.

Shrimp is the most valuable commercial fishery resource of the South Atlantic states, and the total catch has remained fairly stable over the last 25 years at approximately 25 million pounds. Notable exceptions are the poor catches in 1977 and 1978 (18 and 20 million pounds, respectively) when the shrimp crop was greatly reduced by the severe winters.

These two bad years encouraged the further development of and participation in supplemental fisheries for species such as reef fishes (snapper-grouper) and rock shrimp. Many shrimpers have historically engaged in the winter groundfish fishery offshore North Carolina during the offseason.

The shrimp fishery in the South Atlantic consists mainly of browns (*Penaeus aztecus*) and whites (*P. setiferus*) although pinks (*P. duorarum*) contribute a large part of the North Carolina catch. Shrimp are taken commercially by otter trawls; 3,684 shrimp trawl units were reported operating in the South Atlantic in 1976. Most fishing trips are only a day or two in duration and most of the fishing grounds are within six miles of shore.

In recent years landings of rock shrimp (*Sicyonia brevirostris*) have increased, and the fishery has extended from Florida into Georgia and South Carolina. The fishing grounds extend to 50 miles offshore Georgia (Reimold, 1980).

At present there is no rock shrimp fishery offshore North Carolina due to low abundance and low market prices (Taylor, 1979).

Other major fisheries in the South Atlantic are menhaden, blue crabs, reef fish, and swordfish. Menhaden are harvested in purse seines off North Carolina and northeast Florida. Although menhaden is not a food fish, it is nevertheless economically important. Blue crab was the second most valuable fishery in 1976, worth over $5 million. Blue crabs and other estuarine species such as mullet, oysters, and clams support substantial fisheries in the South Atlantic area.

Fisheries for reef fishes, snapper, grouper, porgy, and black sea bass, have developed largely over the last decade. These fishes are habitat limited and there are thoughts that the stocks in this area are presently fished to, or over capacity. Longlining for swordfish has increased tremendously in importance during the past several years.

The shelf north of Cape Hatteras supports a sizable trawl fishery for overwintering Mid-Atlantic groundfish stocks. Clark and Brown (1977) report a 62% decline in relative abundance of finfish and squids in the Mid-

Table III-1

Range and Mean Annual Catch for South Atlantic States
for the Years 1971 through 1976, inclusive
Data is from CFS SR-4 series*

	CATCH	
	Weight (million lbs.)	Value (million $)
State	——————— Range and Mean ( ) ———————	
North Carolina	138-238 (188.0)	11-27 (17.2)
South Carolina	19-24 (21.2)	7-14 (10.2)
Georgia	15-18 (17.3)	7-12 (9.3)
Florida (East Coast)	46-72 (62.7)	9-20 (16.2)
Totals (all 4 states)	240-322 (288.1)	42-74 (55.0)

*Notes: Totals may not add because of rounding. Data is not yet available for subsequent years. SR-4 Series used for compilation of this table are: CFS Nos. 7703, 7408, 7229, 6818, 6568, and 6230.

Table III-2

South Atlantic Landings in Relation to U.S. National Landing for Various Years

Year	Value of Landings in Million Dollars	Percentage of U.S. Catch	Weight of Landings in Million Pounds	Percentage of U.S. Catch
	——— U.S. Catch ( ) ———			
1978	96 (1854)	5.2	399 (6028)	6.6
1977	72 (1515)	4.7	345 (5198)	6.6
1976	72 (1353)	5.3	315 (5350)	5.9
1975	61 (971)	6.2	327 (4842)	6.8
1974	48 (898)	5.3	300 (4940)	6.1
1973	57 (907)	6.2	241 (4732)	5.1
1972	44 (704)	6.3	284 (4710)	6.0
1971	41 (643)	6.4	255 (4969)	5.1
1970	29 (602)	4.8	279 (4884)	5.7
1969	36 (518)	6.9	319 (4292)	7.4
1960	20 (354)	5.7	379 (4942)	7.7
1950	19 (347)	5.4	261 (4901)	5.3
1940	4 (99)	4.1	325 (4060)	8.0

NOTE: Figures are rounded.
Landings data is from Fisheries of the U.S., CFS No. 7800, 7500, 7200, 6900, 6700, 6400, 6100, and 5600.

Table III-3

Major Fishing Ports in the South Atlantic Area

NORTH CAROLINA	SOUTH CAROLINA
Wanchese	Shem Creek
Beaufort-Morehead City	Beaufort
Southport	McClellandville
Pamlico	Georgetown
Hobucken	Rockville
Belhaven	Edisto Beach
Oriental	
Atlantic	
Wrightsville Beach	
Carolina Beach	
GEORGIA	**FLORIDA (Northeast Coast)**
Thunderbolt	Fernandina
Valona	Mayport
Darien	St. Augustine
Brunswick	
St. Mary's	

Table III-4

Employment in Commercial Fisheries in the Four South Atlantic States

	Employment	
	Number of Fishermen*	Number of persons in processing and wholesale plants*
1978	not available	not available
1977	not available	5,417
1976	10,560	5,695
1975	10,242	6,138
1974	9,991	5,663
1973	9,805	5,694
1972	8,851	5,638
1971	9,264	5,496

*CFS SR-4 Series - Nos. 7703, 7408, 7229, 6818, 6568, and 6230
**Fisheries of the U.S. - CFS Nos. 7800, 7500, 7200, 6900, 6700, and 6100

Atlantic area during the 1967-1974 time period. Significant declines in relative abundance was reported for Cape Hatteras to Gulf of Mexico areas.

6. Recreation

a. Coastal Zone

The South Atlantic coastal shorefront is one of the major recreational areas of the U.S., particularly in connection with saltwater fishing (bay, surf, and pier) and beach-oriented activities. Major marine recreational finfish species sought in the coastal zone include: drum, croaker, spot, flounder, sheepshead, shad, striped bass, bluefish, sea trout, cobia, and channel bass. Additionally, shellfishing (especially crab, oyster, and clams) is an important marine recreational activity among coastal residents. Table III-5 provides estimates of resident participation in the principal recreational activities associated with the marine environment in the coastal zone of the South Atlantic states affected by this proposal.

Table III-5

MARINE RECREATIONAL ACTIVITIES
Estimated Number of People Participating by State or Residence
and Type of Recreational Activity, 1974

State of Residence	Saltwater Fishing	Shellfishing	Swimming	Sailing	Pleasure Boating	Beach Combing	Diving
			Thousands				
North Carolina	1,120	445	1,689	187	693	1,274	70
South Carolina	396	283	842	76	319	608	34
Georgia	557	251	1,055	112	494	732	51
Florida 1/	2,101	989	4,026	598	1,847	2,760	462

1/ Includes participation in recreational activities in marine environments associated with the South Atlantic and Gulf of Mexico.

Source: Mabry, E., D. Deuel and A. Kirsch. 1977. Participation in Marine Recreational Fishing, Southeastern United States, 1974. Current Fishery Statistics No. 7333, NOAA/NMFS, Washington, D.C.

The shorefront along the coasts of North Carolina, South Carolina, Georgia, and the east coast of northern and central Florida displays a diversity of natural landscapes and seascapes. Predominant among these are the ever-changing elongated, barrier islands which diffuse the energy of the turbulent ocean and provide ingress and egress for water, fish and people through a series of intermittent inlets and sounds. Many of these landscapes have been modified by man to facilitate his needs for commerce, industry, habitation, food, defense, and recreation. Barrier islands, coastal beaches, inlets, sounds, bays, river deltas and marshes along with a subtropical climate provide an ideal setting for outdoor recreation and tourism.

Visual 4 generally depicts the concentration of major state and nationally recognized public interest areas in the coastal zone. Appendix C lists the shorefront land and water resources and important characteristics related to the resources. Included are publicly-owned areas like national seashores, parks, beaches and wildlife lands, as well as specially designated preservation areas, such as historic and natural sites and landmarks, wilderness areas, wildlife and estuarine sanctuaries, and attractive rivers some of which have potential for special desig-

nation and protective status. Commercial and private recreational facilities and establishments such as resorts, beach communities, amusement parks, marinas and piers, curio and souvenir shops, restaurants, lodging and entertainment facilities also serve as primary interest areas and support services for the millions of people (residents and tourists) who seek enjoyment, or derive their support from the recreational resources influenced by the Atlantic Ocean. The U.S. Fish & Wildlife Service is producing more detailed graphics (scale 1:250,000) displaying the sensitive recreational, fish and wildlife resources of the U.S. Atlantic coastal zone. The specific purpose of this project, which should be completed in the fall of 1980, is to develop ecological information useful in evaluating energy development proposals. Additional discussion and description of the different public and private areas found along the South Atlantic coastal zone, which provide recreational opportunities with indications on the governmental controls, policies and plans related to these resources, may be found in the individual state Coastal Zone Management Plans and the Statewide Comprehensive Outdoor Recreation Plans on file in the four states potentially affected by this proposal. Furthermore, the Bureau of Land Management has contracted for and had published a comprehensive summary of the unique and endangered environments of the South Atlantic. This report describes in detail over 60 national, international, state, and private programs or systems of environmental-ecological recognition and management existing along the Atlantic coast from Cape Hatteras, North Carolina to Cape Canaveral, Florida (Center for Natural Areas, 1979). A recently issued report and draft environmental statement entitled, "Alternative Policies for Protecting Barrier Islands Along the Atlantic and Gulf Coasts of the United States" provides additional information on the importance and characteristics of the barrier islands along the South Atlantic Seaboard (USDI, HCRS, 1980). A detailed discussion of coastal recreation resources and activities in South Carolina and Georgia is included in Chapter IX, Vol. II of the Sea Islands Characterization (S.C. Wildlife & Marine Res. Dept., in press).

To summarize, the diverse environments found in coastal areas where water and land converge are a magnet for leisure pursuits. The coastal beaches, barrier islands, estuarine bays, and sounds and tidal marshes found from Cape Hatteras to Cape Canaveral are increasingly utilized for recreational activity by residents from the South Atlantic states and tourists throughout the nation, as well as many foreign visitors. A significant element of the economy of the coastal plains region is tied to the quantity, quality, and diversity of natural and developed recreational resources associated with the South Atlantic coastal zone.

b. Offshore

The open northwestern Atlantic, or that area extending from a few miles offshore to the shelf break, encompasses a broad expanse of saltwater which is of intense interest to sports fishermen, generally classed as "deep sea" fishermen, and a small but rapidly increasing number of SCUBA divers. Their specific destination sites offshore vary significantly but some special features and designated sites are known to have special recreational interest. Each of the South Atlantic states has a program encouraging the development of artificial fishing reefs for fishermen and divers. Several shipwrecks are charted and are widely recognized by some fishermen and divers as recreation destination sites. Natural features such as the Gulf Stream, exposed hard bottoms, coral reefs, the shelf break and other unusual topographic features are likewise potentially of special value to recreational interest venturing into the offshore environment. Estimates by professional researchers familiar with the bottom characteristics of the South Atlantic would indicate that 3-25% of the continental shelf is composed of special bottom features with known sport fish concentrations (Parker, 1978). One area off North Carolina has been designated a marine sanctuary to protect an important historic resource (U.S.S. Monitor, shipwreck) and another attractive live bottom area known as Gray's Reef off Georgia is an active candidate for marine sanctuary designation. Visual 4 identifies the location of the designated, permitted, artificial reefs and specially protected resources in the study area for this offshore lease proposal. Sections VI and VII of the Angler's Guide (USDC, NMFS, 1976) also depicts many offshore fishing and diving areas (reefs, shipwrecks) off the South Atlantic states and indicates which sport fishes might be associated with the features identified.

The 1978-1979 marine recreational fishing survey sponsored by the National Marine Fisheries Service will provide the most up-to-date information on regional participation and recreational fish harvest in the offshore zone of the South Atlantic Ocean. Human Sciences Research, Inc., of McLean, Virginia, should publish survey results in the summer of 1980 estimating participation, catch, and effort by charter boat/headboat fishermen and private boat fishermen in the South Atlantic area.

Coastal residents and many tourists rent spaces on charter or headboats for the purpose of deep sea fishing or SCUBA diving in the Atlantic Ocean east of the coastal plains states. Table III-6 indicates over 300 boat-for-hire businesses extending all along the eastern seaboard cater to recreational fishermen. Some of these fishermen troll for big game or billfish such as marlin and sailfish associated with the offshore waters, but the greatest proportion of deep sea fishermen seek out the snapper, grouper, black bass, porgies, and grunts directly associated with the natural and artificial reefs of the continental shelf and the mid-water predators (cobia, mackerels, jacks, baracuda, and sharks) found in these same locations. The recently published draft fishery management plans for the Atlantic Billfishes (white and blue marlin, sailfish, and spearfish) and for the Coastal Migratory Pelagic Resources (king and Spanish mackerels, cobia, bluefish, and dolphin) contain very specific data on the biology, catch, effort and socio-economics related to these very important marine recreational fish species (South Atlantic and Gulf of Mexico Fishery Management Councils, 1979 & 1980). Additional information on different aspects of the marine recreational fisheries relating to South Carolina and Georgia is summarized in Chapter VII of the Fish & Wildlife Service's Sea Islands Characterization (S.C. Wildlife & Marine Resources Dept. - Marine Resources Dept., 1980, in press). Other published research by Huntsman, 1976; Manooch & Laws, 1979; Liao and Cupka, 1979; Bell, 1979; and the Center for Natural Areas, Chapter X, 1979 discuss in detail the offshore recreational fisheries off the South Atlantic states and its significant economic implications. A study done for the National Marine Fisheries Service indicated the gross economic value of marine recreational fishing to the South Atlantic states amounted to almost $300 million and 8,000 jobs in 1975 (Centaur Management Consultants, Inc., 1977). Table III-7 shows a breakdown of this estimate into its various economic components.

In conclusion, economic, food, and recreational value of saltwater fishing for fun is a significant and renewable component of coastal society in the South Atlantic region of the United States.

7. Tourism

The Atlantic Ocean, its beaches, associated historical features, national seashores and resorts are tourist destination areas contributing significantly to the economy of the coastal region. Major natural and developed attractions such as the Outer Banks of North Carolina, the Grand Strand area of South Carolina, Jekyll Island in Georgia and Daytona Beach in Florida are nationally recognized recreation, vacation, convention and business meeting areas accommodating millions of visitors annually. The economic viability of many small coastal communities as well has become dependent on the expenditures of visitors traveling to and through their areas. Although efforts are made to maintain a steady flow of visitors all year long, the spring and summer are the peak use seasons associated with beach and ocean attractions.

A recent travel study sponsored by the Coastal Plains Regional Commission (1979) determined the environmental factors of climate and geography were the primary characteristics of the South Atlantic coastal region likely to attract tourists. The abundance of beaches, over 2,000 miles, associated with an Atlantic coastline of more than 1,000 miles, encased in an area having sunny weather 63% of the time and a yearly mean temperature of 69°F, accounted for its current importance and future potential as a tourist destination area. The following table reflects the relative linear extent of beach and shore resources in the coastal plains region between North Carolina and Florida (Coastal Plains Regional Commission, 1979).

State	General Coastline*	Tidal Coastline*	Beaches*
North Carolina	301	3375	1269
South Carolina	187	2876	196
Georgia	100	2344	102
Florida	460	4169	620
TOTAL	1048	12764	2187

* Linear Miles

Table III-6

Major Charter and Head Boat Ports Between Cape Hatteras, North Carolina and Cape Canaveral, Florida

State/Port	Number Charter Boats	Number Head Boats
NORTH CAROLINA		
Kitty Hawk	5	
Kill Devil Hills	3	
Nags Head	3	
Manteo	15	
Manns Harbor	4	
Wanchese	8	
Hatteras	10	1
Ocracoke	8	
Frisco	1	
Harkers Island	3	
Beaufort	2	
Morehead City	20	1
Atlantic Beach	10	1
Marshallberg	3	
Swansboro	17	
Sneads Ferry	5	1
Topsail Beach	1	
Wrightsville Beach	1	
Wilmington	3	
Carolina Beach	11	4
Kure Beach	2	1
Southport	5	1
Holden Beach	3	
Shallote	3	
TOTAL	146	10
SOUTH CAROLINA		
Little River	8	11
Murrells Inlet	8	10
Georgetown	2	1
Charleston	1	4
Johns Island	2	1
Mount Pleasant		2
Fripp Island	2	
Hilton Head	17	3
Goose Creek		1
Garden City	7	
TOTAL	47	33
GEORGIA		
Savannah	7	1
St. Simons	5	
Brunswick	2	
Jekyll Island	2	
TOTAL	16	1
FLORIDA*		
Fernandina Beach	7	
Mayport	8	4
Jacksonville Beach	4	
St. Augustine	2	
Micco	6	
Ormond Beach	†	
Daytona Beach	12	
Port Orange	†	1
Ponce Inlet	†	7
New Smyrna Beach	†	
Cocoa Beach	†	
Melbourne	†	1
Port Canaveral	8	3
TOTAL	47	16
GRAND TOTAL	256	60

* Head boat figures for Florida are accurate.
Charter boat figures for Florida are estimates.
† Indicates a suspected presence of charter boats.

Source: R. L. Schmied, NMFS, St. Petersburg, FL, October 1979.

Table III-7

Economic Impacts of Marine Recreational Fishing in the South Atlantic Region — 1975

	Sales (thousands of dollars)	Value-Added (thousands of dollars)	Wages & Salaries (thousands of dollars)	Employment (person-years)	Annual Capital Expenditures (thousands of dollars)
Fishing Tackle					
Manufacturing	9,890	6,260	2,720	430	430
Wholesale Trade	11,100	1,040	820	90	70
Retail Trade	23,600	9,020	2,740	400	680
Boats					
Manufacturing	14,150	6,210	3,000	420	170
Retail Trade	21,170	3,360	1,590	210	120
Motors					
Manufacturing	5,060	2,300	860	60	150
Retail Trade	6,890	1,070	520	70	50
Trailers					
Manufacturing	1,530	710	260	30	50
Retail Trade	1,830	310	140	20	10
Marinas	24,430	9,770	6,600	660	490
Commercial Sport-fishing Vessels	22,260	13,320	6,460	890	1,550
Boat Fuel					
Manufacturing	4,990	810	90	10	220
Wholesale Trade	7,430	710	150	20	110
Retail Trade	8,750	1,430	500	110	70
Food	46,780	16,860	10,760	2,270	1,270
Lodging	10,950	5,740	2,900	600	300
Travel					
Manufacturing	24,800	4,290	580	40	1,100
Wholesale Trade	36,930	3,540	900	90	560
Retail Trade	43,450	5,040	3,170	560	350
Boat Insurance	5,700	1,320	500	40	---
Bait	42,770	8,510	3,500	530	260
Other	30,330	6,070	3,640	540	610
TOTAL	288,910	107,690	52,400	8,090	8,820

Source: Centaur Management Consultants, Inc. 1977. Economic Activity Associated with Marine Recreational Fishing. Prepared under Contract for NOAA/NMFS, Washington, D.C.

Visual 4 depicts the major recreation and beach areas utilized by tourists between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Appendix C attempts to list the major designated public interest, oceanfront areas of the South Atlantic seashore and provide important features about each one.

Travel expenditures in the coastal counties of North Carolina with ocean shorefront amounted to almost $150 million directly supporting 12,430 industry related employees from over 2,000 active firms in 1978 (Skelton, Angela. N.C. Dept. of Administration, 1980). New Hanover County which encompasses the historic city of Wilmington and shorefront destination sites such as Wrightsville, Carolina, Wilmington and Kure Beaches accounts for over 40% ($60 million) of all coastal travel expenditures and tourism related employment. Dare County, which includes many of the Outer Banks and Cape Hatteras National Seashore (1978 visitation-1,800,000), accounted for 19% ($27.5 million) of all travel expenditures in coastal North Carolina. The following table provides an indication of the relative value in expenditures, employment and businesses of the travel and vacation industry in all oceanfront counties within North Carolina in 1978 (Smith, Jim. N.C. Dept. of Natural Resources & Community Development, 1980).

County	All Travel Expenditures	Recreation and Tourism Employees	No. Active Firms
New Hanover	$ 59,745,000	4894	608
Dare	27,522,000	1562	254
Onslow	24,808,000	2696	455
Carteret	16,937,000	1754	305
Brunswick	7,084,000	960	207
Currituck	2,918,000	200	53
Pender	2,677,000	295	93
Hyde	1,831,000	69	31
TOTAL	$143,522,000	12430	2006

In South Carolina during 1978, the state's four main beach resort destinations had a total visitation of over 10 million persons who spent more than a billion dollars. This represents approximately 78% of the state's entire non-resident tourism expenditures for that year. These four major destination areas with respective visitations and expenditure figures follow:

Destination Area	No. Visitors	% Statewide	$ Expenditures	% Statewide
Grand Strand (Myrtle Beach)	6,500,000	38.0	642.1 million	48.3
Charleston	2,800,000	16.0	264.5 million	19.9
Beaufort	200,000	1.4	22.6 million	1.7
Hilton Head Island	600,000	3.5	110.3 million	8.3
TOTAL	10,100,000	58.9	1,039.5 million	78.2

Source: Liming, Robert. S.C. PRT, 1979.

The Georgia coast is known for its sea islands, many of which are managed for natural values, where transportation to the seashore does not encourage concentrated shorefront public use. Chatham County, which includes Savannah Beach and Glynn County encompassing Jekyll and St. Simons Islands, are exceptions and cater to a large tourist population interested in seashore enjoyment. At our request, the Georgia Department of Industry and Trade, in consultation with the University of Georgia's Office of Leisure Studies and Tourism, developed a methodology to estimate the economic value of tourism at Georgia's most popular beach communities. They believe either the percent of the county's tourism-related sales, or the percent of its tourism-related income compared to total county-wide sales and income are good indicators on the importance of tourism. Their findings, based on 1977 data, are as follows:

County	Chatham	Glynn
Tourism-related Sales	$ 141,228,637	$ 55,140,710
Total Retail Sales	715,110,000	226,620,000
Percent of Total	20%	24%
Tourism-related Personal Income	$ 34,754,109	$ 19,634,028
Total Personal Income	1,197,700,000	320,600,000
Percent of Total	3%	6%

Source: Dobbs, Ralph. Georgia Department of Industry and Trade, 1979.

More detailed and extensive discussion on the socio-economic aspects of coastal tourism in South Carolina and Georgia is included in Vol. II, Chapters II and IX of the Sea Islands Characterization prepared for the U.S. Fish & Wildlife Service (S.C. Wildlife and Marine Resources Department, in press).

Tourism is Florida's number one industry with annual visitation approaching 35 million people. Approximately 500,000 Floridians are involved in tourist related employment, and tourism expenditures approached $13 billion statewide in 1978. This means tourists spend about $35 million a day in Florida. The state's recreation plan (Fla. DNR, 1976) indicates two-thirds of her visitors participate in beach activities. The 1978 Florida Tourist Study indicates Duval and Volusia Counties are the 7th and 8th most popular destinations with air travelers, and Volusia County is second only to the counties associated with Walt Disney World as a destination for tourist arriving by auto. Volusia County, which includes the Daytona Beach area, attracted 3,308,100 tourists in 1978; whereas, Duval County, encompassing the Jacksonville Beaches, had a tourist population of approximately one million persons in 1978. With an average expenditure per person trip at $400, Volusia and Duval Counties alone accounted for approximately $1,720,000,000 of the the state's tourist expenditures in 1978 (Fla. Division of Tourism, 1979). Although Volusia and Duval Counties account for the most numerous visitation in northeast Florida, the entire east coast, from Fernandina Beach in Nassau County to Cape Canaveral National Seashore (1978 visitation - 883,000) in Brevard County, are strongly influenced by beach related tourism.

Section IV

Environmental Consequences

IV

IV. ENVIRONMENTAL CONSEQUENCES

A. Resource and Offshore Infrastructure Estimates

The resource and offshore infrastructure estimates for proposed Sale 56 were furnished to BLM, New Orleans OCS Office (November 5, 1979) by USGS Conservation Division, Eastern Region. This data is summarized in tables IV-1 and 2. Pipeline and development well estimates in these tables were calculated by BLM using data furnished by USGS.

The oil/gas resource estimates for this proposal are based on the total acreage under closure from which associated hydrocarbons could be economically developed, basic reservoir data, and recovery factors. The estimates indicate that if the area is hydrocarbon productive, there exists a 5% probability that recoverable resources will be less than 0.8 billion barrels of oil and 1.4 trillion cubic feet of gas. There exists a 95% probability that resources will be less than 2.1 billion barrels of oil and 3.5 trillion feet^3 of gas. The resource estimates are risked, their probabilities apply only to the tentative sale as a whole, and there is an additional geologic risk for the occurrence of hydrocarbons within any given structure.

The resource estimates and their associated development scenarios are based primarily on subjective judgment, due to the limited amount of engineering, geological, and operational data available in the U.S. South Atlantic OCS region.

B. Development Assumptions and Scenarios

1. Offshore Development Scenarios

The proposed lease sale tracts are divided into 2 geographic groups related to the most likely locations for shore based service operations, in order to facilitate analysis of onshore impacts. The Northern Tract Group is comprised of 130 tracts located offshore North Carolina, while the Southern Tract Group includes the 156 tracts located offshore from Jacksonville, Florida to Charleston, South Carolina (see figure IV-1).

Offshore oil and gas development scenarios for the two tract groups are shown in table IV-3. These scenarios are based on the USGS resource estimates and development scenarios as well as the following assumptions:

- Total estimated recoverable oil and gas resources are distributed between the Northern and Southern Tract Groups in direct proportion to each groups share of the total number of proposed tracts, i.e., the Northern Tract Groups contains 45% of the total number of proposed tracts and is therefore assumed to contain 45% of the total estimated oil resource and 45% of the total estimated gas resource; similarly the Southern Tract Group accounts for 55% of the total proposed tracts and 55% of the total estimated oil and gas resources.
- Exploration and development drilling is distributed in direct proportion to the assumed distribution of oil and gas resources between the two tract groups.

In the Northern Tract Group Development Scenarios exploratory and development drilling activity occurs over a 10 to 11 year period (1984-1994 for the low resource estimate scenario and 1984-1993 for the high resource scenario). Peak oil and gas production occurs in 1994 and 1993 for the low resource estimates (LRE) and high resource estimate (HRE), respectively.

For the Southern Tract Group Scenarios exploratory and development drilling activity taxes places over an 11 or 12 year period (1982 to 1992, LRE and 1982 to 1993, HRE). Peak oil and gas production is reaced in 1992 (LRE) and 1993 (HRE).

2. Industry Procedure Assumptions and Estimates

The number of exploratory and development rigs (or rig years) required to accomplish the drilling activity scenarios described above are based on the assumptions listed in table IV-4 below. Estimates of rig requirements based on these assumptions are shown in table IV-5. The maximum exploratory rig requirement for both

Table IV-1

Estimated Resources and Offshore Infrastructure

	Low (5%)	Mean	High (95%)
A. RESOURCES			
1. Total Production			
a. Oil (billion barrels)	0.8	1.4	2.1
b. Gas (trillion cubic ft.)	1.4	2.5	3.5
2. Daily Peak Production			
a. Oil (barrels)	216,700	326,800	490,100
b. Gas (million cubic ft.)	384.9	617	841
B. OFFSHORE INFRASTRUCTURE			
1. Wells Drilled			
a. Exploratory/Delineation	101	101	101
b. Development	360	1,299	1,299
2. Platforms Installed	13	56	56
3. Pipelines Constructed (miles)*	140	340	540

Sources: USGS, 1979 and BLM, 1980.

*BLM estimate.

Table IV-2

Estimated Offshore Infrastructure Development Timetable

	WELLS DRILLED			
Year	Exploration 1/ LRE-MRE-HRE	Development* LRE-MRE-HRE	Platforms Installed LRE-MRE-HRE	Pipelines Constructed (Miles)* LRE-MRE-HRE
1982	15-15-15			
1983	15-15-15			
1984	15-15-15			
1985	15-15-15			
1986	15-15-15			
1987	15-15-15			
1988	11-11-11	21- 96- 96	3-12-12	40-60-90
1989		63-280-280	3-11-11	30-60-90
1990		84-264-264	3-11-11	20-60-90
1991		77-264-264	2-11-11	20-60-90
1992		62-264-264	2-11-11	20-60-90
1993		42-131-131		10-40-90
1994		12- 0- 0		
TOTAL	101-101-101	360-1299-1299	13-56-56	140-340-540

Sources: USGS, 1979 and BLM, 1980.

*BLM estimate by year.

1/ Delineation wells are included with exploratory wells in this and all subsequent tables.

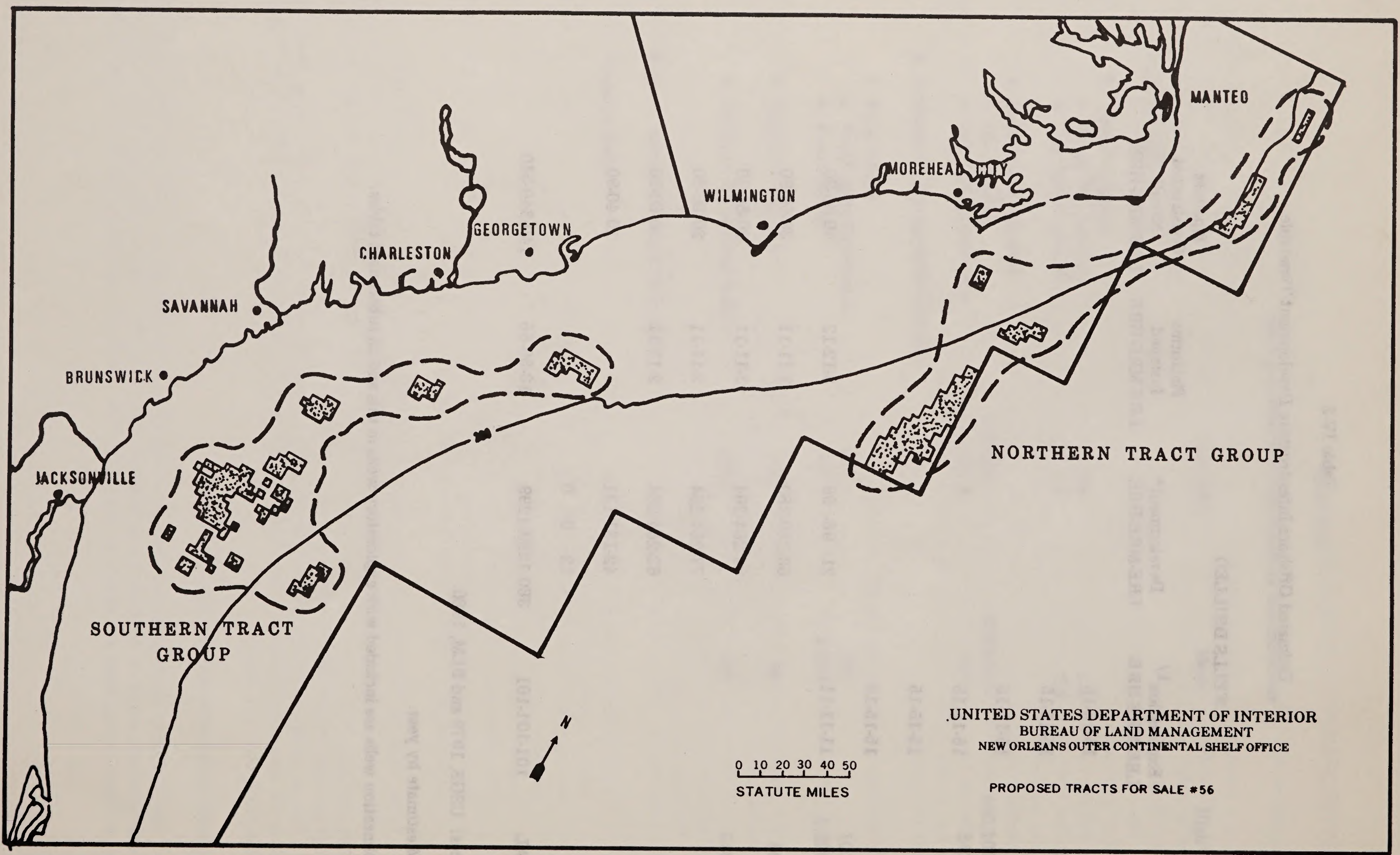


Figure IV-1 — Northern and Southern Tract Groups for Proposed Sale 56.

Table IV-3

Northern Tract Group and Southern Tract Group Offshore Development Scenarios

Year	Northern Tract Group Scenarios					Southern Tract Group Scenarios				
	Wells Drilled		Platforms	Daily Production		Wells Drilled		Platforms	Daily Production	
	Exploratory LRE—HRE	Development LRE — HRE	Installed LRE—HRE	Oil (MBOPD) LRE — HRE	Gas (MMCFP) LRE — HRE	Exploratory LRE—HRE	Development LRE — HRE	Installed LRE—HRE	Oil (MBOPD) LRE — HRE	Gas (MMCFP) LRE — HRE
1982						15 — 15				
1983						15 — 15				
1984	4 — 4					11 — 11				
1985	9 — 9					6 — 6				
1986	12 — 12					3 — 3				
1987	12 — 12					3 — 3				
1988	9 — 9					2 — 2	21 — 96	3 — 12	13 — 36	22 — 62
1989		0 — 16	0 — 2	0 — 6	0 — 10		63 — 264	3 — 9	50 — 135	90 — 233
1990		14 — 80	2 — 6	8 — 36	15 — 62		70 — 184	1 — 5	92 — 204	165 — 351
1991		42 — 160	2 — 8	34 — 96	60 — 165		35 — 104	0 — 3	113 — 243	202 — 419
1992		56 — 200	2 — 9	67 — 171	120 — 295		5 — 64	0 — 2	116 — 267	208 — 460
1993		42 — 124		92 — 218	165 — 378		0 — 7		105 — 270	187 — 465
1994		12 — 0		100 — 198	178 — 339				94 — 245	168 — 422
1995				90 — 179	160 — 307				85 — 222	151 — 382
2000				48 — 108	87 — 186				57 — 135	101 — 232
2005				30 — 66	53 — 113				34 — 82	61 — 140
(Total)	46 — 46	166 — 580	6 —25			55 — 55	194 — 719	7 — 31		

Source: BLM, 1980.

Table IV-4

Industry Procedure Assumptions

	Resource Estimate Low	Resource Estimate High
Exploration Phase:		
wells per rig per year	3.75	3.75
Development Phase:		
rigs per platform	2	2
wells per rig per year	7	8
drilling period (years per platform)	2	1.5
Production Phase:		
production well per platform (average)	27.7	23.2

Source: BLM, 1980.

Table IV-5

Offshore Development Scenario Estimates
Exploratory and Development Rig Requirements

	Northern Tract Group		Southern Tract Group	
Year	Exploratory Rig Years LRE–HRE	Development Rig Years LRE–HRE	Exploratory Rig Years LRE–HRE	Development Rig Years LRE–HRE
1982			4.0 – 4.0	
1983			4.0 – 4.0	
1984	1.1 – 1.1		2.9 – 2.9	
1985	2.4 – 2.4		1.6 – 1.6	
1986	3.2 – 3.2		0.8 – 0.8	
1987	3.2 – 3.2		0.8 – 0.8	
1988	2.4 – 2.4		0.5 – 0.5	3 – 12
1989		0 – 2		9 – 33
1990		2 – 10		10 – 23
1991		6 – 20		5 – 13
1992		8 – 25		0.7– 8
1993		6 – 15.5		0 – 0.9
1994		1.7 – 0		

Northern Tract Group Scenarios is 3.2 rig years occurring in 1986 and 1987; for the Southern Tract Group Scenarios the maximum requirement is 4.0 rig years occurring in 1982 and 1983. Development rig requirements are much greater reaching a peak of 25 rig years for the Northern Tract Group - HRE Scenario in 1992, and a peak of 33 rig years for the Southern Tract Group - HRE Scenario in 1989. These rig requirements are the primary factors determining the required levels of onshore support activities and facilities which are discussed in Section IV.C.3. below.

C. General Impact Producing Factors and Related Environmental Consequences

The OCS oil and gas development activities which would result from the proposed sale could eventually result in a variety of impacts on the natural environment, on air and water quality, on land use patterns, on the aesthetic quality of the coastal zone, on the adequacy of local and regional infrastructure, and on the local and regional economic and social well being. This section provides a general overview of how routine operations and occasional accidents attendant to OCS oil and gas development generate effluents or impact agents which, either directly or indirectly, can cause adverse environmental consequences. The probable adverse impacts which could result from these impacts agents are briefly described in general terms.

1. Oil and Gas Spills and Other Accidents

In the course of complex OCS operations involving heavy equipment, flammable materials, working at sea with many employees, and reliance on complex technology, it is inevitable that accidents will occur. Proper analysis of these accidents is a complex problem. The history of OCS petroleum development accidents in the Gulf of Mexico provides a substantial data base for estimating the frequencies of future accidents. More detailed discussions of these topics are included in the final environmental impact statements for OCS Sales 43 and 58 (USDI, BLM, 1977, pp. III-10 to III-21 and USDI, BLM, 1979, pp. III-10 to III-14, respectively).

a. Oil Spills

Oil spills are recognized as the most common cause of environmental pollution associated with offshore oil and gas activity. All phases of petroleum development from exploration to production have the potential for causing or contributing to oil spills.

Table IV-6 contains data on the annual number and volume of oil spills for a recent five year period (1971-1975) in the Gulf of Mexico. The statistics for this period are believed to be representative of the general character of oil spills over a much longer period of time and indicate the following general spill characteristics:

— The vast majority of oil spills are small (99.7% were less than 50 barrels and 85% were less than 1 barrel).
— Over a period of several years most of the volume of oil spilled is contributed by a few large spills (0.5% of the spills accounted for 91% of the oil spilled).
— Major oil spills (1,000 barrels and over) are few in number and exhibit a low average number of occurrences per year (however, during the 1971-1975 period, 3 spills occurred in one year and 2 spills occurred in the following year).

During this five-year period, approximately 1.8 billion barrels of oil were produced from the Gulf of Mexico. This gives us a spill rate of 1 barrel spilled per 51,421 barrels produced, or 0.0028% spillage (Danenberger, 1976). Resource estimates for the Sale 56 proposed tracts range from 0.8 to 2.1 billion barrels of oil to be produced over a period of 30 years. Simple calculations give us an estimated average spill rate for the tracts offered in this sale of 747 to 1,960 barrels per year.

Alternative A

The oil spill risk analysis model (Appendix D) indicates that the expected number of spills greater than 1,000 barrels, the only spill size considered by the model, is three over the 30 year life of Sale 56 related produc-

Table IV-6

Number and Volume of Spills Each Year, 1971-1975
Gulf of Mexico Outer Continental Shelf

Year	SPILLS OF LESS THAN 50 BARRELS				SPILLS OF 50 BARRELS OR MORE 1/					All spills
	Less than 1 bbl	1-14 bbl	15-49 bbl	Total	50-499 bbl	500-999 bbl	1,000-9,999 bbl	10,000 bbl or more	Total	Total
NUMBER OF SPILLS										
1971	913	321	11	1,245	11	0	0	0	11	1,256
1972	953	202	4	1,159	2	0	0	0	2	1,161
1973	1,005	162	4	1,171	1	0	3	0	4	1,175
1974	1,051	75	3	1,129	6	0	1	1	8	1,137
1975	1,021	100	5	1,126	2	0	0	0	2	1,128
1971-75	4,943	860	27	5,830	22	0	4	1	27	5,857
TOTAL VOLUME (BARRELS) OF SPILLS										
1971	228	1,008	257	1,493	1,285	0	0	0	1,285	2,778
1972	238	703	91	1,032	150	0	0	0	150	1,182
1973	251	585	85	921	240	0	21,935	0	22,175	23,096
1974	263	329	75	667	675	0	2,213	19,833	22,721	23,388
1975	255	344	112	711	266	0	0	0	266	977
1971-75	1,235	2,964	620	4,824	2,616	0	24,148	19,833	46,597	51,411

1/ Includes seven spills of 50 barrels each: 5 spills in 1971, and 1 spill each in 1972 and 1974.

Source: Danenberger, 1976.

tion activities. The most likely number of spills, however, is only two over the same time span. A total of 6 spills is predicted, however, in view of the risks associated with existing Sale 43 leases (minor risk) and existing tanker tarffic (major risk) into and out of regional ports. There is a near certainty of at least one spill occurring (95% probability due to Sale 56; 99% probability due to Sales 56 and 43, plus existing transportation).

Additionally, the oil spill model indicates that the areas most likely to be sites of spill landfalls lie between Cumberland Island, Georgia, and Amelia Island, Florida (land segments 18 and 19). The model (table 12) predicts the following probabilities for one or more spills to occur and contact coastal areas within 3, 10, and 30 days of the spill incident:

Land Segment	Approximate Coastal Area	Number of Days to Reach Land 3	10	30 days
4	Okracoke Island, North Carolina (Cape Hatteras region)	n	2%	4%
9	New Inlet to Shalotte Inlet, South Carolina (Cape Fear region)	1%	2%	3%
17	St. Catherine's Island to Jekyll Island, Georgia	n	2%	6%
18	Jekyll Island to Cumberland Island, Georgia	8%	14%	19%
19	Cumberland Island, Georgia to Amelia Island, Florida	1%	5%	10%

(n = less than 0.5% probability)

These spill probabilities include consideration of probable spills from existing OCS (Sale 43) leases and from existing transportation, as well as proposed Sale 56. The high probabilities for spills occurring and reaching the Georgia coast are heavily influenced by existing tanker traffic in the area. Spills reaching the Cape Fear area are of interest since this is the only area, other than the high probability areas, where a landfall within 3 days is predicted. Minor risk for spills occurs throughout the entire coastline (Appendix D, table 12) considered by the model; the areas discussed here are the areas of highest risk. The most likely source of the oil spill predicted to landfall in the Jekyll Island to Cumberland Island, Georgia area is the tanker route (T-10) between the offshore lease tracts and Brunswick, Georgia, an anticipated operations and onshore facilities site (Appendix D, tables 6 and 7). In general, risks of oil spills for the North Carolina coast come from the northern group of tracts, while risks of oil spills for the coasts of South Carolina, Georgia, and Florida are due to the southern group of tracts and transportation. In general, trajectories from offshore spill sites influenced by the Gulf Stream are northward to the Cape Hatteras vicinity, then sharply northeastward, away from potential landfalls.

The oil spill model does not differentiate or predict among the various possible causes or sources of oil spills. Spills may result from oil well blowouts, explosions or fires, severe storms, tanker or tank barge operations or accidents, and from eventual pipeline accidents.

Conclusion

Leasing of all tracts proposed under Alternative A will result in 1-3 major (1,000 barrel) oil spills during the 30 year life of sale-related production. The most likely area to be impacted is the Jekyll Island, Georgia, to Amelia Island, Florida area; other likely impact areas include coastal Georgia just north of the high-risk area, and to a lesser degree coastal North Carolina. A minor risk exists for the entire coastline.

Cumulative Impact

Impacts to date as a result of Sale 43 are summarized in Section I.E.1. and consist primarily of development of new dock facilities in Brunswick, Georgia, and drilling of 6 dry holes in the Sale 43 area. Cumulative impacts of the two sales, at time of writing, seem to be a reiteration of estimated Sale 56 impacts: three major (1,000 barrel) oil spills during the 30 year life of production, with major spill impact occurring along coastal Georgia.

Alternative B

Implementation of Alternative B-1 (deletion of fisheries tracts) would eliminate 15% of the proposed tracts, and so might reduce the probability of oil spills and other impacts to the same degree. More specifically, this alternative would remove most of the northern group of tracts from the sale, and so would greatly reduce the probability of an oil spill affecting the coast of North Carolina.

Implementation of Alternative B-2 (deletion of deepwater tracts) would eliminate 45% of the proposed tracts, and so would reduce the probability of oil spills to an even greater degree. This alternative would essentially eliminate any probability of an oil spill affecting the coast of North Carolina.

Implementation of Alternative B-3 (deletion of nearshore tracts) would eliminate 2% of the proposed tracts. The only significant reduction in risk to be attained by this alternative would be a lesser probability of an oil spill reaching the coast of North Carolina within 3 days.

Conclusion

Implementation of Alternatives B-1, B-2, or B-3 would reduce the size of the sale and the probability of oil spills by 15, 45, and 2%, respectively. More importantly, Alternatives B-1 and B-2 would greatly reduce or eliminate the northern tracts, and so would greatly reduce the probability of an oil spill affecting the coast of North Carolina. The probability of an oil spill affecting the coast of Georgia would be reduced to some extent by these alternatives, but that area would remain the most likely to be impacted.

Alternative C

Implementation of Alternative C (Delay the Sale) would delay any impacts, but would probably not change the nature or extent of anticipated impacts.

Alternative D

Implementation of Alternative D (Withdraw the Sale) would eliminate any impacts projected for the proposed sale.

(1) *Pipeline Accidents:* During OCS operations in the Gulf of Mexico, more oil has been spilled from pipeline accidents than from all other types of OCS petroleum production accidents. During the period of February, 1967 to July, 1979, a total of 21 pipeline breaks and/or leaks, each with a spillage of 50 barrels or more, were reported (USDI, GS, 1979a). The total volume of oil spilled due to these accidents is approximately 207,323 barrels. Of these 21 pipeline spills, 6 (28.6%) were caused by anchor dragging. These 6 spills, however, contributed 90.1% of the total oil spilled due to pipeline breaks or leaks.

The USGS (in USDI, BLM, 1980a, p. 80) has noted that since 1970 more than 70% of the total volumes of oil reported spilled from pipelines was the result of anchors associated with drilling rigs, derrick barges, pipelaying barges, and ships dragging across the pipelines and causing them to be dislocated, kinked, split, or ruptured. Other causes of pipeline damage include movement and/or shear due to wave action and unstable bottom conditions which, in some instances, resulted in mudslides; fouling of trawling gear on subsea valves and taps; and internal corrosion of the line due to formation water that is produced with oil. Only a small percentage of anchor-related problems are due to ships anchors, as opposed to problems involving anchoring systems associated with oil and gas operations. The USGS is unaware of a single documented instance in the Gulf of Mexico of damage caused to a pipeline by the boards used to hold trawling gear open, although incidents occur frequently involving trawling gear such as nets, ropes, or tickler chains getting hung on pipeline-related obstructions such as taps and valves.

During the same 1967-1979 period discussed above, the total production of oil and condensate in the Gulf was approximately 3.99 billion barrels, giving a spill rate of 0.0052%. As of 1979, the pipeline networks serving the Gulf OCS included almost 11,000 miles of pipelines in the federal sector of the Gulf of Mexico plus approximately 1,100 miles of pipelines that transport OCS production through state waters (USGS, in USDI, BLM, 1980a, p. 78).

Using these spill rate and pipeline mileage figures, we can attempt to predict the number of pipeline breaks which might occur and result in oil spills in the South Atlantic OCS area. The number of spills estimated ranges from 1, based on comparisons of pipeline mileage, to 11, based on comparisons of production. The volumes of oil estimated to be spilled, based on production data, range from approximately 41,500-108,900 barrels to be spilled during an estimated 4-11 spills with an estimated average spillage of 9,800 barrels per incident. The actual probability of oil spills due to pipeline breaks or leaks in the South Atlantic OCS region is less, however, because of the emphasis on transportation by tankers, rather than by pipelines at least in the early stages of regional development. Pipelines are not expected to be emplaced sooner than 1988. Additionally, since all pipelines that might be constructed in the South Atlantic will be "new" and can be constructed by state-of-the-art methods, they should be less prone to spillage than some of the existing, older lines in the northern Gulf.

Starting in 1969, several actions have been undertaken to reduce the chances of such accidents and to reduce the volume of these spills. Burial of all new common carrier pipelines, with a minimum cover of three feet (10 feet in shipping fairways and anchorage areas) was required by BLM for rights-of-way permits in water depths of less than 200 feet. In water depths of less than 200 feet, only the lines in the gathering system between adjacent platforms of a particular oil or gas field may remain unburied. Permits to construct these gathering lines are granted by GS and the decision on whether to require burial is made on a case-by-case basis. These administrative actions have substantially reduced the risks of future pipeline ruptures due to anchor dragging.

Additional safeguarding of OCS pipelines and mitigation of accidental spills is provided by regulations promulgated by the Office of Pipeline Safety (OPS) of the Department of Transportation. Petroleum pipelines in offshore areas are required to be coated with tightly banded materials impervious to moisture, followed in many cases by a layer of dense concrete for mechanical and corrosion protection. To protect against electrolytic corrosion, impressed currents of sacrificial anodes are required. The OPS regulations requiring protection devices and pressure monitoring systems which, coupled with regular inspection of the pipeline route for leaks and other irregularities, should also substantially reduce the risk of pipeline oil spills.

Other features used by industry serve to further mitigate against accidents include: continuous metering systems, automatic high pressure shut-downs, and remotely controlled mainline block valves that can isolate sections of the line.

(2) *Blowouts:* It is possible for wells to blow out of control during drilling operations, completion and production. Blowouts may be prevented during drilling by increasing mud weight and activating blowout preventers. When a well is completed, a subsurface safety device is installed to prevent the well from blowing out if surface control is lost.

Information from the Northern Gulf of Mexico for the period June, 1956 to July, 1979 shows a total of 16 blowouts which occurred with loss of oil and/or condensate (USDI, GS, 1979a). The total spillage of these 16 blowouts was 63,193 barrels; however, for several blowouts the reported spillage is listed only as "minimal," so the actual number of barrels is probably slightly larger.

Total production for the Northern Gulf during this period was approximately 4,840 billion barrels of oil and condensate (USDI, GS, 1979b), giving a spill rate of 0.0013%. Using this rate, we can project a total spillage due to blowouts for the Sale 56 tracts at 10,400 to 27,300 barrels over the 30-year life of the field.

Most blowouts causing spillage result from producing oil wells, not wells being drilled. Producing oil well blowouts are normally a result of equipment malfunctions, workover procedures, human errors, storms, and collisions. Northern Gulf of Mexico OCS statistics indicate that an average of one blowout occurs for every 250 wells drilled (Danenberger, 1980). No blowouts resulting in significant spills of oil or condensate have been reported from the northern Gulf of Mexico since December, 1974 when a 200 barrel blowout occurred during repairs of hurricane-caused damage (USDI, GS, 1979a).

A serious blowout did occur, however, in the southern Gulf of Mexico off the Mexican coast. A Petroleos Mexicanos (Pemex) platform blew-out on June 3, 1979, near the fishing village of Ciudad del Carmen, one of the world's richest shrimping/fishing grounds. Subsequent to the blowout, a mixture of escaping oil and gas ignited, destroying the well and a semi-submersible platform valued at $22 million. No lives were lost. The Pemex disaster resulted in the release of an unknown quantity of natural gas and an estimated 30,000 bbls of crude oil per day. As of July 9, 1979, it became the largest oil spill in history, surpassing the Amoco Cadiz disaster off the coast of France in 1978 which spilled 1.3 million barrels of crude oil. Despite repeated attempts to control the well by

capping and by directional drilling of relief wells, the well continued to flow out of control until successfully capped on March 23, 1980. An estimated 3.3 million barrels (140 million gallons) of oil were spilled during the 295 days of uncontrolled flow (OSIR, 1980). Some oil reached Texas beaches during the late summer and early fall of 1979, but was kept off U.S. Gulf Coast beaches during the winter months by seasonal circulation patterns. It is very unlikely an oil spill of this magnitude could occur in the South Atlantic OCS region as a result of this proposal because the geology, oil/gas resource estimates, drilling operations, regulations, and inspection procedures are very different.

Impacts from oil spills will be determined by amounts of oil reaching the coast, duration of the continuing spill, weathering of oil prior to reaching coastal areas, and effectiveness of mitigatory measures taken by appropriate federal and state agencies.

(3) *Explosions and Fires:* Fires have always been a major hazard in the petroleum industry. OCS operations are no exception. Geological Survey statistics (USDI, GS, 1979a) indicate that most of these fires have been extinguished before serious damage and pollution occurred. During the period of June, 1956 to July, 1979, a total of 294 explosions and fires were reported. Most were of relatively minor consequence. However, 16 (5.4%) resulted in near or total loss of the platform or rig, and 10 (3.4%) resulted in spills. The magnitude of spills ranged from 1 to 53,000 barrels; total spillage was 87,142 barrels, with 2 spills resulting from fires or explosions contributing 95.8% of the total. Using total production of oil and condensate in the Gulf as a basis for comparison with estimated production of oil for the Sale 56 area, we can project that over the 30-year life of the field there will be 3-4 major platform fires resulting in total or near-total loss of the structure, and there will be 2-3 spills as a result of structure fires.

Due to the history of fire-related massive oil spills, OCS Orders were amended to require extra safety precautions to reduce the potential for future fire-related oil spills. To eliminate blowouts due to malfunctioning velocity-actuated downhole safety devices, OCS Order No. 5 requires surface actuated safety devices. Since 1971, explosion and fire accidents have not resulted in more than minimal (20 barrels or less) oil spills in the Gulf of Mexico (USDI, GS, 1979a).

(4) *Severe Storms - Hurricanes:* Severe storms are the violent disturbances of the atmosphere characterized by strong winds that are usually accompanied by some form of precipitation and/or thunder and lightning. The more violent aspects of the weather are associated with cyclonic rotating whirlpools of air called vortices (Miller and Thompson, 1970). The three principal types of vortices are: the wave cyclone, which is the largest but usually not the most violent; the tropical cyclone that is smaller in size and much more destructive; and the tornado, which is the smallest but has the most powerful effects. The tropical cyclone is a natural phenomenon that has the greatest potential for adverse impact on offshore oil/gas activities.

The Atlantic tropical cyclone basin, which is one of the six in the world, includes much of the North Atlantic Ocean, the Caribbean Sea, the Gulf of Mexico, and a substantial portion of the adjacent coastal areas. The outer continental shelf onto which expanding activity has placed the petroleum industry is also a part of this tropical cyclone basin, which is a geographical area influenced by tropical cyclones.

Any closed circulation in the Northern Hemisphere in which the winds rotate counter-clockwise (clockwise in the Southern Hemisphere) is called a cyclone. When one developes over tropical waters it is referred to as a tropical cyclone. Deriving its energy from the latent heat of condensation of water vapor, the tropical cyclone is a large-scale nonfrontal low pressure weather system with definite organization. Occurring most frequently between May and November, a tropical cyclone is classified according to sustained surface wind speed measured near the center of the system as a: tropical depression (less than 33 knots), tropical storm (34-63 knots, inclusive), and hurricane (64 knots and greater) (Neumann, et al., 1978). A great hurricane is one having sustained surface wind speeds of 109 knots or greater.

Hurricanes vary considerably in intensity, track pattern, and behavior (see visual 7, Hurricanes and Earthquakes). There is a high probability that one can cause extensive damage to some segment of the coastal area each year. Realizing this, and that planning for the expansion of metropolitan areas and industrial sites along the hurricane-prone Atlantic and Gulf coastlines needed a summarization of hurricane events, Simpson and Lawrence (1971) reviewed all pertinent cyclone events between 1886-1970. Since the unpredictability of hurricane frequency precludes any climatological summary being considered a stable assessment of the risk of storm recur-

rence at any one locality their effort was directed toward preparing the best possible information for planning purposes. Figure IV-2 shows coastal segments as well as earliest and latest month and day of landfall for tropical cyclones in each segment. A guide to the frequency and severity of some type of severe storm crossing the coastline of a sector of the South Atlantic region may be obtained by using figure IV-2 in conjunction with figure IV-3, which is a histogram showing the probability (in percent) of occurrence in any one year for a 50 mile segment of coastline. It is noted that during the 79 year period, 1899-1977, a total of 65 hurricanes crossed the coastlines of North Carolina, South Carolina, Georgia, and the east coast of Florida at one or more points. Of this number, 21 were called major hurricanes, i.e., their winds were between 96 and 113 knots, inclusive. The probability of future occurrences based on climatological averages compiled from data accumulated over many years is standard procedure and may be considered a reliable guide.

Annual hurricane threats have been an important consideration to the petroleum industry since offshore operations began over 30 years ago. Its activities are ruled by the daily presence of the dangerous potential of a natural phenomenon that is now beginning to be understood. The designing of equipment to weather severe storms of the sort experienced in the waters over the outer continental shelf in the North Atlantic Ocean off the coast of the southeastern U.S. is not dissimilar to that for a like area in the Gulf of Mexico. However, this is not sufficient. There is always the possiblity of that once-in-a-lifetime hurricane with exceptional violence. Called the 100-year storm, it is defined by weathermen as a storm of such magnitude that is is unlikely to occur more than once in a century. Hurricane Hazel, who roared ashore near Cape Fear, North Carolina, in 1954 after meandering across the Caribbean for several days, may have represented this type of storm. It was probably the most severe tropical storm in over 100 years in that area, and one of the most severe combined tropical and extratropical storms ever to visit the northeastern U.S. Devastation by combined wind and wave action along the coast was severe. Every fishing pier along the coast from Myrtle Beach, South Carolina, to Cedar Island, North Carolina, was destroyed; a distance of 170 miles. Despite the severity of the storm and a total damage estimate along the Carolina beaches of $61,000,000, there were only 19 casualties. The latter attests to the excellent warnings and concern of public spirited individuals who spent long hours, at great personal risk, to alert the populace (Dunn and Miller, 1960).

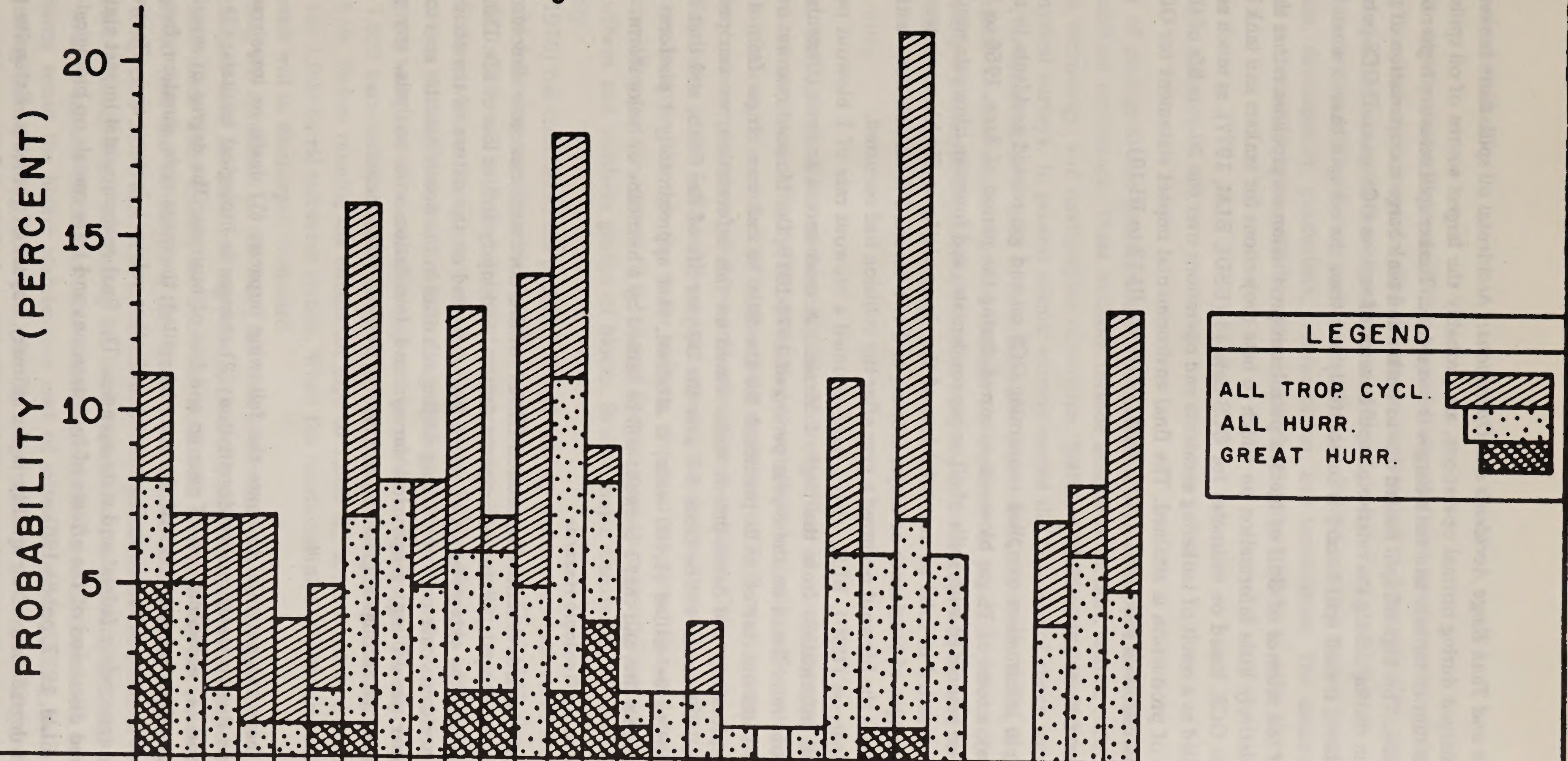
Evaluating the significance of oil spills related to offshore oil and gas development for any lease area in the South Atlantic region is basically probabilistic. Along with the uncertainty concerning the number and size of spills that might occur, as well as wind and current conditions that would exist at the time, there are reflected uncertainties that are inherent with the problem. In addition, there is no record of an oil spill related to production activity in the South Atlantic region as there is in the Gulf of Mexico. Here, on October 3, 1964 and for several days thereafter, blowouts of gas and oil from damage caused by Hurricane Hilda resulted in destruction of three platforms in the Eugene Island Area. Approximately 5,180 barrels of oil were spilled, but there was no recorded environmental damage. The uncertainty of predicting future oil spill impacts can be relieved by considering the possible impacts that could accompany the oil and gas development by considering the "worse case" conditions. For more detail on oil spill risk analysis , see Appendix D.

(5) *Ships Colliding with Platforms:* Commercial vessels can collide with OCS platforms, typically causing substantial damage to both the vessel and the platform. Considering the number of platforms in the Gulf of Mexico and the intensity of shipping traffic, the number of such incidents is surprisingly low. Only four such accidents are reported by the Geological Survey (USDI, GS, 1979a). The first occurred in July, 1960 when a ship collided with a platform off Louisiana. A gas blowout, fire, and total loss of the platform occurred. In April, 1964 a freighter collided with another platform off Louisiana, again resulting in a fire and damage to both the freighter and the platform. Approximately 2,559 barrels of oil were spilled during this incident. In August, 1975 the GLOBTIK SUN collided with a platform off Louisiana, resulting in damage to both the vessel and the structure. Oil from the GLOBTIK SUN ignited and the tanker caught fire. Most recently, a collision which occurred between a freighter and yet another platform off Louisiana may have contributed to a gas blowout approximately a year later.

In view of the low incidence of ships colliding with platforms in the Gulf of Mexico, and the low number of platforms projected for the Sale 56 area, there is a very small possibility that such an accident will occur in the South Atlantic OCS area.

Figure IV-2 — Earliest and latest tropical cyclone occurrences for the period 1886-1970. Numbers within boxes are the month and date of earliest and latest landfalls for the indicated coastal segment (Simpson and Lawrence, 1971).

This histogram and table shows the probability (percentage) that a tropical storm, hurricane, or great hurricane will occur in any one year in a 50 mile segment of the coastline. Figure IV-2 identifies the numbered coastal segments.



COASTAL SECTOR	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
ALL TROPICAL CYCLONES	11	7	7	7	4	5	16	8	8	13	7	14	18	9	2	2	4	1	1	1	11	6	21	6	–	–	7	8	13
ALL HURRICANES	8	5	2	1	1	2	7	8	5	6	6	5	11	8	2	2	2	1	–	1	6	6	7	6	–	–	4	6	5
GREAT HURRICANES	5	–	–	–	–	1	1	–	–	2	2	–	2	4	1	–	–	–	–	–	–	1	1	–	–	–	–	–	–

Figure IV-3 — Probability Occurrence Histograms for Tropical Cyclones in the U.S. South Atlantic Region.

(6) *Tanker and Tank Barge Accidents and Operations:* Accidental oil spills from tankers and tank barges, as well as oil discharged during normal operations, are probably the largest source of oil spills in the U.S. Transportation of petroleum in tankers and tank barges is hazardous. Tanker spill rates are higher than the total of all other OCS spill rates. This high oil spill hazard due to tanker and tank barge transportation of petroleum is a very important factor in distinguishing the relative oil spill hazards of various OCS areas. If OCS petroleum production can be piped to shore, the oil spill hazard is substantially less than the oil spill hazard when tankers and barges are used.

Because of the reliance of Gulf of Mexico petroleum production on pipelines rather than tankers or tank barges, there is relatively little information on which to base projections for tankers and tank barge accidents for the South Atlantic OCS. Based on estimates for OCS Sale 43 (USDI, BLM, 1977), as much as 9,496,000 barrels of oil may be spilled as a result of tankering accidents and operations over the 30-year life of the Sale 56 tracts, if the high estimate of production is attained. The final environmental impact statement for OCS Sale 43 includes several pages of discussion on this topic (USDI, BLM, 1977, pp. III-13 to III-19).

b. Natural Gas Leaks Associated with Blowouts

According to information compiled concerning OCS oil and gas related accidents in the Gulf of Mexico (USDI, GS, 1979a), a total of 76 gas blowouts occurred during the period of June, 1956 to July, 1979. Nine of these incidents were associated with spills of oil or gas condensate, and fourteen blowouts resulted in fire. Fifteen of these blowouts resulted in total or near-total loss of the rig or platform. Six blowouts resulted from damages incurred during passages of hurricanes or major storms, and two resulted from collisions with ships, although in one of the latter cases the blowout occurred a year after the collision had occurred.

Previous analyses (USDI, BLM, 1979) have assumed a blowout rate of 1 blowout per 245 wells drilled based on historical information from the Gulf of Mexico. A more recent analysis (Danenberger, 1980) corroborates this blowout rate. Based on the 8-year period of 1971-1978, the blowout rate was one blowout per 250 wells drilled. The total number of wells predicted for the Sale 56 call area ranges from 461 to 1,400 wells, including both exploratory and development wells. Based on this information, we can project that the total number of gas well blowouts will be from 2-6 over the 30-year life of the fields, and that if the high estimate of number of wells to be drilled (1,400 wells) is attained, that approximately 1 platform will be lost, that 1 blowout will result in a fire, and that 1 blowout will be caused by a hurricane or major storm.

c. Accidents Caused by Geologic Hazards

The geologic hazards described in Section III.A.7. of this document can cause structural failures or drilling accidents resulting in oil spills, extensive property damage, and injury and/or loss of life. Damage to the environment could also result, the extensiveness of which would depend on the nature of the accident and the amount of oil spilled. No accidents have occurred during drilling activities in the South Atlantic area to date.

With proper pre-drilling, geophysical surveys and foundation soils analysis, any potential geological hazards can be mitigated through engineering and drilling program modifications.

d. Generic Adverse Impact of Oil Spills

Oil spills have the potential to cause the following impacts: (1) death or impairment to offshore and onshore organisms due to water quality degradation; (2) changes in biological habitats; (3) pollution of recreational beaches; and (4) economic cost of cleanup and loss of business. The degree of severity of these impacts will depend on the chemical properties of the material spilled; the magnitude, duration, frequency, and location of actual spill occurrences; ambient environmental and other relevant factors; and effectiveness of mitigatory actions taken by appropriate federal and state agencies. The final environmental impact statement for OCS Sale 58 includes a good discussion of the effects of hydrocarbons and trace metals on biological organisms and communities (USDI, BLM, 1977, pp. 84-125).

Localized degradation of air quality is the primary impact of gas leaks. Extensive property losses, and injury or death to workers can result from gas leaks producing explosions or fires.

2. Routine Offshore Activities

This section briefly describes the activities required after the lease sale to explore for and produce any oil or gas that might be present. A more detailed discussion is presented in Appendix C to the FEIS for Sale 43. Estimated resources and an estimated development timetable are given in Section IV.D.1.

The activities involved in achieving peak production are divided into six stages: geophysical exploration, drilling exploration, development, production, transportation, and termination. The assumption is made that normal operations as described below will be utilized for development likely to take place in the U.S. South Atlantic OCS.

a. Geophysical Exploration

A number of geological and geophysical techniques have been developed over the years to assist in the prediction of petroleum occurrence. These methods include seismic refraction, seismic reflection, gravity, magnetics, bright spot technology, and stratigraphic correlation. Surface vessels of the 50-300 ton class are utilized to perform geophysical surveys. In general seismic surveys record the behavior of shock waves through various rock formations. This information is used to determine the presence of salt domes, folds, faults, sediment thickness, and gas pockets. Shallow seismic surveys indicate the presence of potentially hazardous conditions to be avoided when locating a platform. Experience indicates that two or three ships will be used to perform this work, each surveying several blocks on each sortie from port.

b. Exploratory Drilling

Exploratory drilling operations are basically the same regardless of mobile rig type (jack-up drilling rigs, drillships, and semi-submersibles). Initially, a drive casing is installed along with a blowout preventer. The casing is either jetted into place or driven into the bottom with a pile driver. Drill mud is circulated through the drill stem and casing to contain subsurface pressures and remove rock cuttings. Cuttings are washed and discharged overboard where they settle to the bottom. Some mud remains attached to the cuttings when they are discharged. As the cuttings cascade down through the water column, the mud is washed free and creates a turbid plume trailing with the prevailing surface current. it is believed that no more than two drilling rigs at a time will be used in each of the northern and southern groups of blocks. Several major discoveries, of course, may increase this number significantly.

Otteman (1976) has considered the problem of drill cuttings and muds which result from offshore drilling and has presented the following analysis which is based upon experience in the Gulf of Mexico.

"The first 150+ feet will be drilled or jetted with seawater. The resulting seawater mud will be returned directly to the sea floor without being pumped to the rig. While drilling the hole to 1,000 feet, typically only seawater will be used as drilling fluid; and it will be discharged overboard. When the formation clays do not make a viscous enough mud, some natural bentonitic clay will be added to the system. The discharged water amounts to approximately 7,000 barrels (for a typical 10,000 ft. well), and it will contain mostly natural mud generated while drilling the hole. Before running the conductor pipe to 1,000 ft., approximately 6 tons of bentonite clay will be added to the 1,000-barrel saltwater system. When the conductor pipe is cemented, this volume of bentonite clay in seawater will be discharged overboard.

"While drilling the remainder of the hole, the mud is continuously cycled back through the mud system. Some mud is discharged with the drill cuttings; and periodically drilling mud is discharged overboard to make room for natural mud made while drilling the hole. The maximum discharge will not exceed 200 barrels a day while drilling to 5,000 feet and 50 barrels a day from 5,000-10,000 feet. During approximately 20 days of drilling to 10,000 feet, some 2,000 barrels of bentonite clay and lignosulfonate treated mud would be discharged overboard. We would possibly begin converting the mud system from a seawater gel mud to a lignosulfonate treated freshwater mud at around 6,000 feet. This decision would be based on the relative economics of hauling freshwater from shore versus the higher maintenance cost of saltwater muds. During the additional 70 days operations while drilling from 10,000-18,000 feet, the discharge rate will not exceed 50 barrels a day; approximately 4,000 barrels of lignosulfonate drilling mud would be dumped overboard. When the well is completed, the mud remaining in the surface system is discharged overboard; and this can amount to as much as 800 barrels."

Most of the wells drilled as a result of this proposal should be more or less 10,000 feet in depth. Using this depth as an "average," we can estimate total volumes of muds and cuttings discharged as follows: (1) exploration, 101 wells, 51,611 yd^3 of cuttings, 459,550 barrels of muds; (2) development, low estimate, 360 wells, 183,960 yd^3 of cuttings, 1,638,000 barrels of muds; and (3) development, high estimate, 1,299 wells, 663,789 yd^3 of cuttings, 5,910,450 barrels of muds. This sounds like, and indeed is, a great deal of material, but it must be kept in mind that these amounts will be discharged into a very large body of water in which dilution and dispersion is rapid, and such discharge will be over a period of several years. Furthermore, the estimates assume production, since if no producible quantities are discovered there will probably be far fewer than 101 exploration wells drilled; Sale 43, with no discoveries, resulted in only six exploratory wells drilled.

There is some concern regarding the environmental impacts of these drilling muds and cuttings. A great deal of effort and money has been expended, and is continuing to be expended, in trying to resolve this problem. The latest attempt was a 3½ day symposium on Research on Environmental Fate and Effects of Drilling Fluids and Cuttings held in Orlando, Florida, on January 21-24, 1980. The proceedings of the symposium should be available in the summer of 1980. Over 350 scientists, industry representatives, environmental group representatives, and representatives of federal, state, and local governments attended. It is the judgment of the biologists of the New Orleans OCS Office, BLM, based on that symposium and numerous reports of government and industry sponsored research, that two positive statements can be made: (1) many muds used in normal offshore drilling operations do indeed contain materials toxic to marine organisms — but only at concentrations 4 or 5 orders of magnitude higher than those found more than a few meters from the discharge point, and (2) dilution is extremely rapid in offshore waters, to the extent that every substance measured in the water column, including turbidity, is at background certainly at a distance of 2,000 m, and probably within 1,000 m. This is not to say that there is nothing to worry about and that there is no problem. The stipulation discussed in Section I.C.2.b. is designed to provide an assessment of any impacts in appropriate cases, and BLM, EPA, and NOAA are continuing to fund extensive research programs both in the field and in the laboratory. More information is needed on how points 1 and 2 above interact. But we believe that points 1 and 2 above do allow us to state that drilling operations on the OCS can proceed as presently anticipated provided that the biological stipulation is adhered to and that as new information becomes available, stipulations and operating procedures are modified accordingly. It is the contention of BLM that the biological stipulation, as contained herein, reflects this proviso.

c. Development

Field development drilling creates the same effluents as exploratory drilling only spatially more concentrated since as many as 10-20 wells may be drilled from a single platform. Observations in the Gulf of Mexico indicate that these drill cuttings form low mounds on the sea floor with a maximum relief of approximately 20 cm. These cuttings will be worked into the surrounding sediment by bioturbation or colonized by sessile organisms to form a miniature reef. It is estimated that anywhere from 360-1,255 development wells may be drilled as a result of this proposal and from 13-47 platforms.

d. Production

The production phase of OCS oil and gas operations consists of those steps necessary to bring the product to the surface and prepare it for transport. Production wastes include formation waters associated with the extracted oil, sand, and other solids removed from the formations, deck drainage from the platform surface, and sanitary wastes. The sand is disposed of directly unless it contains oil, in which case it must be treated before disposal. Formation waters are relict sea water but with anomalous ion ratios. The sanitary wastes from offshore oil and gas facilities are composed of human body waste and domestic waste such as kitchen and general housekeeping wastes. Combustible solids are burned on site and non-combustibles are transferred to shore for disposal. Thirteen to fifty-six (13-56) platforms are estimated to result from this proposal.

e. Transportation

Transportation of the products which may be produced from the area may require the installation of large diameter (61-91 cm) pipelines. Present OCS operating regulations require burial of pipeline in water depths of less

than 200 feet. Present requirements for granting BLM rights-of-way permits stipulate burial to a depth of 3 feet where the overlying water depth is 200 feet or less. Gathering lines from clustered rigs or proximate fields do not have this requirement, as they are considered part of the production system, and are generally not buried as commercial ship traffic is at a minimum close to rigs. However, because they are small diameter lines they tend to sink into the sediments by themselves. During pipeline burial, a large volume of bottom sediments are disrupted and suspended in the water for a short period of time. In general, the environmental impacts of pipeline burial are very similar to those of discharges of drill cuttings and drilling muds:

— Dredging in nearshore areas will often result in resuspension of many years' accumulation of such materials as organic matter, phosphates, and other nutrients, as well as toxic heavy metals and pesticides, if present.

— On hard bottoms, dredging will eliminate suitable sites for attachment of the biotic communities dependent upon hard substrate attachment (sponges, soft and hard corals, seaweeds, sessile molluscs). This impact will persist throughout the pipeline burial path either permanently or until the substrate gradually becomes recompacted.

— Displaced material can smother the burrowing and attached benthos. This can occur where these materials settle to the bottom and accumulate to significant depths.

— Increased turbidity in all locations where these activities occur. The small sized particles causing this turbidity can temporarily clog the respiratory organs of many marine organisms and the filter-feeding mechanisms of numerous others. This increased turbidity is a short-term phenomenon, and generally is not significant beyond a few hundred meters of the dredge site.

— In coastal wetlands, pipeline burial operations could displace many species of wildlife during construction and maintenance operations. The effects of pipeline burial in wetlands can have a substantial impact for a duration of one to several years as a result of devegetation and disruption of substrate. An additional potentially significant impact of pipeline burial in coastal estuaries can result from disruption of the water circulation patterns.

— Emplacement can also cause physical damage to unknown cultural artifacts and sites (e.g., shipwrecks and human habitation sites).

Rig and platform installation and anchoring can have similar environmental impacts to those discussed above, though to a lesser degree, due to the smaller area of the sea bottom disturbed.

An alternative to pipeline transportation would be transportation via oil tanker which would increase the risk of spillage. It can be anticipated that, due to the dispersion of tract locations in the proposed sale area, their distance from shore, and the anticipated small pool size, initially transportation of oil would be via tankers. Tankers would probably be of the 16,000-25,000 dead weight tons (dwt) class. Furthermore, unless or until strategically convenient deliverability of about 70,000 barrels of oil per day (BOPD), the construction of an oil pipeline to shore is doubtful. Based on this empirical rule of thumb, no more than two pipelines are predicted to result from the subject proposed sale. The initial dependence on tanker transport is foreseen for 3-5 years after production is commenced. This timeframe, of course, is subject to the timing and quantity of resource discoveries. Therefore, in the period of 1986-1988, an investment decision can be anticipated on whether or not to construct an oil pipeline to shore. (FEIS for Sale 43). It is estimated that should production be sufficient to warrant pipeline to shore, one or two such pipelines would be built with a total of up to 540 miles of pipeline being required.

It is difficult to establish precise routes that pipelines would follow prior to the discovery of hydrocarbon resources. However, assumptions can be made, and tentative areas designated that map provide feasible lineations for pipeline installation.

For this proposed sale, it is estimated that between 140 and 600 miles of pipelines would be required, and that a maximum of 2 onshore terminals could be constructed. The most likely landfalls for these pipelines would be near the probable onshore facility locations of Wilmington, North Carolina and Brunswick-Savannah, Georgia.

The most probable destination point for crude oil produced as a result of the sale would be existing petroleum refineries. Since no general purpose petroleum refineries are located in the coastal portions of the southeastern states, the most probable assumption to make is that the oil would be transported to shore, stored,

and transshipped by tanker to existing refineries in other areas. Transportation from the producing areas to the onshore terminals would probably be done by surface transportation during the initial stages, and by pipeline in later states in the event that the reserves discovered were in large enough quantity. Existing natural gas transportation lines were assumed to be onshore destination points for OCS gas production.

More precise designations of pipeline routes could be estimated when more precise information regarding the location of oil and gas deposits, the quantities of oil and gas, the presence of other valuable resources, and the future availability of facilities for processing oil and gas that might be constructed regardless of the outcome of this proposal.

f. Termination

According to industry estimates, with proper placement of wells and sufficient pipeline capacity, a gas reservoir could be drained in as little as 10 years. In contrast, some oil reservoirs have been producing for over 20 years. When a reservoir has been depleted to a level at which it cannot be profitably produced, operations are terminated.

OCS Orders issued by USGS require wells to be plugged, the casing severed well below the mudline, the platform removed, and all obstructions cleared from the area. Major trunklines may be used for future production from adjacent areas, but smaller lines would probably be abandoned in place. Abandonment consists of purging the lines of entrained hydrocarbons by water flushing (the water disposed of onshore) and severing the ends below the mud line. The necessity for removal of pipelines nearshore is usually regulated by the state. Removal of nearshore pipelines has been completed in isolated cases in the Gulf of Mexico.

3. Onshore Development: Assumptions, Estimates and Scenarios, and Estimated Impacts

a. Facility Requirement Assumptions and Estimates

The onshore facility requirement assumptions for the proposed sale are shown in table IV-7. As indicated in the table, it is assumed that no new refineries will be constructed in the South Atlantic region as a direct result of the proposed sale. Several such facilities have recently been proposed for the region including: a 50,000 barrel-a-day refinery in the Savannah, Georgia area; a 150,000 barrel-a-day refinery in the Wilmington, North Carolina area; a 30,000 barrel-a-day refinery near Morehead City, North Carolina; as well as refineries at locations in Jasper and Georgetown Counties, South Carolina. However, these refineries are still in the planning and regulatory review stage so that their actual development, including their capacity and location, is still undecided.

The assumptions in table IV-7, for most of the facility requirements, are given not as a single value but as a range of values. This has been done to realistically reflect the range of actual industry practice and the influence of locational and resources constraints. For instance, the number of temporary service bases required to support 4 exploratory drilling rigs could easily vary from 1-4. Only one base would be needed if all rigs were being operated by the same company or if a service company established and operated a base for 3 or 4 oil companies. Complicating this even more is the fact that the major oil companies generally set up their own service bases; the competitive nature of the service industry which could result in 3 or 4 bases being set up in different ports by different service companies; and the competition between ports themselves for additional business.

The estimated number of each type of required onshore facility is shown in table IV-8 for each offshore development scenario, while the estimated requirements for each type of onshore facility are discussed in paragraphs c through g below.

b. Onshore Locational Assumptions

The basic assumptions concerning the location of onshore support activities/facilities, and other facilities directly related to offshore operations are as follows:

Table IV-7

Onshore Facilities Requirement Assumptions

Facility	Number Required	Land Area (acres)	Marginal Wharf (lin. ft.)
Temporary Service Base Rigs Served:	Varies: 1 per rig to 1 per 4 rigs		
1		1.5 - 5	200 - 400
2		3 - 9	400 - 800
3		4.5 - 12	500 - 1200
4		6 - 14	600 - 1600
Operations & Administrative Base (Combined)	Varies: 1 per Co. per 200 MBOPD to 1 per 4 Co. per 200 MBOPD	35 - 75	150 - 200 per platform served
Pipeline Installation Service Base	Varies: One base can serve several installation projects	5	200
Marine Terminal Facilities	1 per 200 MBOPD	40	Berthing system for 1 tanker
Gas Processing Plant	Varies: 1 per 0.3×10^6 MBOPD (Min.) 1 per 1×10^6 MBOPD (Max.)	75	-----
Refineries	None. Use of existing refineries outside the region, or proposed refineries in the region, if constructed, is assumed.		
Platform Fabrication Yards	None. Use of existing facilities in Texas and Louisiana, or a potential facility in Mid-Atlantic region, if constructed, is assumed.		

Table IV-8

Onshore Facilities Estimates
Northern and Southern Group Development Scenarios

Year	Northern Tract Group Development Scenario								Southern Tract Group Development Scenario							
	Temporary Service Bases		Operations Bases & Offices		Terminal Facilities		Gas Processing Plant		Temporary Service Bases		Operations Bases & Offices		Terminal Facilities		Gas Processing Plant	
	LRE	HRE	LRE	HRE	LRE	HRE	LRE	HRE	LRE	HRE	LRE	HRE	LRE	HRE	LRE	HRE
1982									1-4	1-4						
1983									1-4	1-4						
1984	1	1							1-3	1-3						
1986	1-3	1-3							1	1						
1988	1-3	1-3							1	1	1	1-2	0	1	0	1
1990		1[a]	1	1-2	0	1				1[a]	1-2	1-4	0	1	0	1
1992		1[a]	1-2	1-4	0	1	0	1		1[a]	1-2	1-4	0	1	0	1
1993			1-2	1-4	0	1	0	1			1-2	1-4	0	1	0	1
1994			1-2	1-4	0	1	0	1			1-2	1-4	0	1	0	1
1996			1-2	1-4	0	1	0	1			1-2	1-4	0	1	0	1
2000			1-2	1-4	0	1	0	1			1-2	1-4	0	1	0	1
2005			1-2	1-4	0	1	0	1			1-2	1-3	0	1	0	1

Notes: a - temporary pipeline installation base

Source: BLM, 1980.

Offshore Development Scenarios	Potential Onshore Locations for Related Activities and Facilities
Northern Tract Group:	State of North Carolina: — Morehead City Area (Carteret County) — Wilmington - Southport Area (New Hanover and Brunswick Counties)
Southern Tract Group:	State of South Carolina: — Georgetown Area (Georgetown County) — Charleston Area (Charleston, Berkeley, and Dorchester Counties) State of Georgia: — Savannah Area (Chatham, Bryan, and Effingham Counties) — Brunswick Area (Glynn County) State of Florida: — Jacksonville Area (Duval County)

The selection of these potential onshore locations is based on the fact that they are the major ports of the South Atlantic region, and as such have adequate channel depths for offshore support vessels and at least nominally adequate port and harbor facilities. Therefore, they represent the most likely locations to be selected for OCS related onshore operations and facilities. The actual locations finally selected, assuming the proposed sale is held and that exploration, development and production activity ensues, will largely depend on the location of the tracts leased, the number of companies involved in offshore operations, the timing of these operations, the availability of sites for bases and other facilities, industrial service infrastructure, as well as social infrastructure and community attitude. Siting considerations are discussed for each type of facility in paragraphs c through g below.

c. Temporary Service Bases

(1) Description

A temporary service base provides the necessary dockside support for exploratory drilling operations. The main activity of a service base is the transfer of equipment, supplies, and workers between shore and offshore operations.

A service base will usually include berthage for supply and crewboats, dock space for transferring supplies, warehousing, open storage areas, and a small amount of office space. A helipad may be located in conjunction with the service base. However, operations may choose to use existing helicopter terminal facilities, or establish new ones when feasible and advantageous to their operations.

Any given port area may serve more than one operator, either with a separate base for each operator or with a single larger base providing common facilities for use by a number of operators. Use of existing port facilities (with the possibility of renovation or construction of new facilities) or commercial facilities is especially desirable during the initial exploratory phase before it is determined whether and where long-term facilities will be required.

The number of temporary service bases established depends on a number of factors, including: (1) the number and distribution of lease holdings; (2) the number of companies with holdings; (3) the schedule at which exploratory activity is to occur; (4) the availability of land and facilities; and (5) the number of companies served from each lease.

(2) Siting Considerations

In order to minimize transportation and development costs, companies will seek existing sites and facilities in ports closest to the offshore activity that can be leased on a short term basis. A port with easy ocean access, a 15-20 foot channel, adequate turning area, and an uncongested inner harbor is desired. Port and marine services should be readily available. Necessary infrastructure includes: water, electric power, transportation and communication services, medical facilities, and waste disposal facilities. Also, companies will give preference to areas capable of providing temporary housing and recreation. Community attitude toward the prospect of a service base is of nearly equal importance. According to industry sources, oil and service companies would try to avoid areas where major local opposition exists or where significant environmental problems might occur, especially if there are viable alternatives.

(3) Assumptions and Estimated Impacts

Assumptions on the number of temporary service bases required and the land and waterfront requirements per temporary service base are included in table IV-7, and the estimated number of bases for each development scenario is included in table IV-8. Peak year estimates of the number of bases and the range in total land and waterfront reqiuirements are as follows:

Development Scenario	Estimated Peak Year Impact Temporary Service Bases		
	No.	Total Land (acres)	Total Marginal Wharf (feet)
Northern Tract Group, LRE	1-3	4.5-15	500-1200
Northern Tract Group, HRE	1-3	4.5-15	500-1200
Southern Tract Group, LRE	1-4	6-20	600-1600
Southern Tract Group, HRE	1-4	6-20	600-1600

The employment impact of temporary service bases is discussed in relation to offshore exploration activities and estimated in Section IV.C.4.a., Employment Impacts.

A number of ports have sites which could be nominally suitable for service bases. The following table indicates the ports which could provide service bases, including a estimate of the potential number of bases which might be located in each port (based on proximity to proposed sale tracts):

Port	Estimated Potential Number of Temporary Service Bases
(Northern Tract Group, LRE & HRE Scenarios)	
Morehead City, North Carolina	1-3
Wilmington, North Carolina	1-3
(Southern Tract Group, LRE & HRE Scenarios)	
Georgetown, South Carolina	0-1
Charleston, South Carolina	1-2
Savannah, Georgia	1-2
Brunswick, Georgia	1-4
Jacksonville, Florida	1-4

Other impact assumptions are as follows:

Water: 5.2 million gallons/rig/year for supply boats;
Air Emissions: hydrocarbons from fuel storage tanks and vehicle operation;
Waste Water Contaminants: hydrocarbons, heavy metals from bilge, and ballast water;
Noise: up to 85 decibels; 24 hours/ day;
Solid Waste: up to 6 tons/day, including oil contaminated drill cuttings;
Land: potential alteration of existing land use/character; however, in conformance with local environmental and land use plans/regulations.
Construction Impact: short term, effectively mitigated.

d. Operations Bases (Permanent Service Bases)

(1) Description

Essentially the same logistical support and services are provided by an operations base during development drilling as does temporary service bases during exploratory drilling.

After a commercially exploitable find is made, the company or companies involved will establish operations bases. The number, size, and location of these facilities depends on several factors, including the number of companies with finds, the number of platforms to be serviced and their offshore location, the location of existing service bases (both temporary and permanent), and the availability of waterfront land for long term use.

The volume of activity at an operations base will be much greater than that which occurs at a temporary base, particularly during development drilling when between 3.6 and 13 times (LRE and HRE, respectively) the number of wells will be drilled. The land use and employment requirements per site will also be correspondingly greater.

(2) Siting Considerations

The siting of operations bases will, as with temporary service bases, be influenced by distance, development cost, land availability, adequacy of harbor facilities, public attitude, and social facilities. The conversion of temporary service bases to operations bases will be considered and undertaken where feasible and advantageous to do so.

(3) Assumptions and Estimates

Assumptions on the numbers of operations bases required, and land and waterfront requirements per operations base, are included in table IV-7. The estimated number of operations bases for each development scenario is indicated in table IV-8. Peak year estimates of numbers of bases, total land, and marginal wharf requirements are as follows:

Development Scenarios	Estimated Peak Year Impact Operations Bases		
	No.	Total Land (acres)	Total Marginal Wharf (feet)
Northern Tract Group, LRE	1-2	35-150	900-1200
Northern Tract Group, HRE	2-4	35-300	3750-5000
Southern Tract Group, LRE	1-2	35-150	1050-1400
Southern Tract Group, HRE	2-4	35-300	4650-6200

The employment impact of operations bases is discussed in relation to offshore development and production activities in Section IV.C.4.a. below.

The following table indicates the ports which could provide sites/facilities for operations bases, and includes a rough estimate of the potential number of bases which might be expected to be located in each port (based on proximity to proposed sale tracts):

Port	Estimated Potential Number of Operations Bases
(Northern Tract Group)	
Morehead City, North Carolina	1-2
Wilmington-Southport, North Carolina	1-2
(Southern Tract Group)	
Georgetown, South Carolina	0-1
Charleston, South Carolina	0-1
Savannah, Georgia	0-1
Brunswick, Georgia	1-2
Jacksonville, Florida	1-2

Other impact assumptions are as follows:

Water: 8 million gallons/platform/year during development drilling;
Air Emissions: same as for temporary service base;
Water Contaminants: same as for temporary service base;
Noise: same as for temporary service base;
Solid Waste: same as for temporary service base;
Land: same as for temporary service base;
Construction Impact: same as for temporary service base.

e. Pipelines, Pipeline Landfalls, and Installation Bases

(1) Description

Marine pipelines are one of two methods for transporting oil and gas to shoreside processing facilities (the other method is tankering). A pipeline system may include a pressure source, gathering pipelines offshore, major trunkline(s), intermediate pressure booster stations, a landfall, and an onshore destination. In addition, during pipeline installation service base support is needed. These waterfront bases, which are established by oil or service companies, can support several installation activities.

(2) Siting Considerations

The major factors used to determine the feasibility of building marine pipelines include the estimated total oil and gas reserves, their distribution, production rates, projected market value of the oil or gas, and capital and operating costs. Large volumes of oil and gas at relatively short distances from shore will generally justify the construction of pipelines where technically feasible. The route and landfall site will be determined so as to minimize distance (construction, operating, and maintenance costs) while taking into consideration adverse seabottom considerations, anchorages, the shoreline, production plans, and environmentally sensitive areas, as well as state Coastal Zone Management (CZM) and local siting policies and plans.

When oil is to be transshipped, the landfall site will be influenced by the availability of a terminal and tank form site. For gas pipeline landfalls, proximity to a transmission line is an important consideration.

Siting considerations for pipeline installation service bases are similar to those discussed for temporary service bases.

(3) Assumptions and Estimates

Assumptions on the number of pipeline installation bases required and the land and marginal wharf requirements of each base are indicated in table IV-7; the number of these required for each development scenario is given in table IV-8. The assumed numbers and locations of oil and gas pipelines landfalls for each offshore development scenario are included in the following table:

Development Scenario	Number of Pipeline Landfalls Oil	Gas	Potential Locations for Pipeline Landfalls
Northern Tract Group, LRE	0	0	—
Northern Tract Group, HRE	1	1	Morehead City Area/Wilmington-Southport Area
Southern Tract Group, LRE	0	0	—
Southern Tract Group, HRE	1	1	Charleston Area/Savannah Area/Brunswick Area/Jacksonville Area

Other impact assumptions for pipelines are as follows:

Air Emission: minimal;
Noise: 90-100 decibels from compressor;
Land: 50-100 foot right-of-way. 40 acres for pumping station, if required. Potential alteration of existing land/character;
Construction Impact: same as for temporary service base.

f. Terminal and Storage Facilities

(1) Description

A marine terminal typically includes dock space for tankers and/or barges, transfer equipment, and storage tanks. These terminals are used when waterborne shipments of crude oil is made. With regard to the proposed sale, marine terminals will be utilized to load crude oil received from offshore platforms onto tankers for referring elsewhere, or possibly to receive crude from offshore platforms for delivery by overland pipeline to a nearby refinery.

(2) Siting Considerations

Proximity to offshore production areas and the requirements for sheltered water of sufficient depth for tankers to be used at the facility are the primary locational determinants. Marine terminal facilities might be developed if offshore production areas are so widely scattered that pipelines or offshore storage is uneconomical, and refineries are very distant. A facility could also be developed if a refinery is planned for the adjacent region and some or all of the offshore production is expected to be refined there. The most likely case for marine terminal development is for use in transshipping pipelined crude to large tankers from a highly productive field which is within 150 miles of shore.

(3) Assumptions and Estimates

Assumptions on the number of marine terminals required, and on the land and marginal wharf requirements of each terminal are included in table IV-7. Estimates of the number of marine terminals required for each development scenario, included in table IV-8, indicate that no facilities will be developed under the low resource recovery scenarios. These scenarios assume that construction of marine pipelines and onshore terminal facilities is

unfeasible, and that offshore storage and loading facilities will be used to transfer crude oil to shuttle tankers (20,000 dwt) for transport to existing refineries. Under the medium resource recovery scenarios (used as the basis for oil spill model analysis), crude oil would be gathered to central offshore storage and loading facilities and then transported by shuttle tankers (20,000 dwt) to onshore marine terminals (one in the general vicinity of Wilmington, North Carolina, and another in the vicinity of Savannah or Brunswick, Georgia), for transshipment by tanker to existing refineries. The high recovery resource scenarios assume that offshore crude production will be transported by marine pipeline to onshore marine terminal facilities for transshipment by tankers to existing refineries outside the region or by overland pipeline to newly constructed local refineries. One pipeline landfall is assumed for each of these development scenarios. The landfall for the Northern Tract Group, HRE Scenario is assumed to be in the vicinity of Morehead City or Wilmington-Southport, North Carolina. Potential landfalls for the Southern Tract Group, HRE Scenario are assumed to include Charleston, South Carolina; Savannah, Georgia; Brunswick, Georgia; and Jacksonville, Florida.

Peak year estimates of the total number of terminals, land requirements, and assumed potential locations are as follows:

Development Scenario	Estimated Peak Year Impact Marine Terminal Facilities		Potential Locations
	No.	Total Land (acres)	
Northern Tract Group, LRE	0	0	—
Northern Tract Group, HRE	1	40	Morehead City Area/Wilmington-Southport Area
Southern Tract Group, LRE	0	0	—
Southern Tract Group, HRE	1	40	Charleston Area/Savannah Area/Brunswick Area/Jacksonville Area

The employment impact of marine terminal facilities is discussed in Section IV.C.4.a. below.

Other impact assumptions are as follows:

Air Emissions: hydrocarbons from tanks and transfers, exhaust emissions from vessels and compressors;

Waste Water Contaminants: BOD; COD; suspended solids; oil and grease from bilge, ballast, storm water; chronic small spills; potential for large spills. Management of these waste contaminants will be in conformance with pertinent Federal, state, and local regulations;

Solid Wastes: contaminated sludge and sediments - disposal in accordance with pertinent Federal, state, and local regulations;

Land: same as for temporary service base;

Construction Impact: same as for temporary service base.

g. Gas Processing Plants

(1) Description

Gas processing plants remove impurities and valuable liquefiable hydrocarbons from the raw gas stream before it enters the commercial gas transmission line. There are no standard sizes or designs for a gas processing plant which is similar in appearance to a refinery though smaller.

(2) Siting Considerations

If a commercially valuable natural gas find is made, the construction of one or more marine pipelines and gas plants is likely. There is no fixed quantity of gas which justifies production; rather, commercial value depends on the richness of the stream, the price of gas, cost of development, and production rate. The preferred location for a gas processing plant is a site somewhere between the gas pipeline landfall and the closest commercial transmission line. These facilities do not require a coastal site.

(3) Assumptions and Estimates

Assumptions on the number of gas processing plants to be constructed, and the land requirements per plant are included in table IV-7. The estimated number of gas plants for each development scenario is indicated in table IV-8. Peak year estimates of the number of gas plants, total land requirements, and potential locations for each development scenario are as follows:

Development Scenario	Estimated Peak Year Impact Gas Processing Plants No.	Total Land (acres)	Potential Locations
Northern Tract Group, LRE	0	0	—
Northern Tract Group, HRE	1	50-75	Wilmington-Southport Area
Southern Tract Group, LRE	0	0	—
Southern Tract Group, HRE	1	50-75	Charleston Area/Savannah Area/Brunswick Area/Jacksonville Area

The employment impact for gas processing plants is discussed in Section IV.C.4.a. below.

Other impact assumptions are as follows:

Air Emissions: hydrocarbons, hydrogen sulfide, sulfur oxides, and nitrogen oxides;
Waste Water Contaminants: suspended solid, oil and grease, heavy metals, phenols, chromium;
Noise: 80-96 decibels from various activities;
Land: same as for temporary service base;
Construction Impact: same as for temporary service base.

4. Employment and Population

a. Total Employment Estimates

Employment estimates for the Northern and Southern Tract Group development scenarios are presented in table IV-9. These estimates are based on the offshore and onshore development scenarios previously described in this section, and assumptions on direct employment per unit of activity or facility (table IV-10), as well as assumptions on the amount of indirect and induced employment generated by OCS activities/facilities.

OCS generated total employment peaks for both Northern Tract Group development scenarios in 1992 at 1,487 (LRE) and 5,099 (HRE). The Southern Tract Group development scenarios peak in different years: 1,936 (LRE) occurring in 1990 and 6,185 (HRE) in 1989.

The employment estimates presented in this section include only those jobs generated offshore and in the adjacent potential onshore development areas. Additional indirect and induced employment (job opportunities) will be generated elsewhere in the nation. Many firms supplying and supporting OCS development will be based outside the South Atlantic coastal region, and employment (including additional workers, if required) necessary

Table IV-9

Employment Estimates (Non-Construction)
Northern and Southern Tract Group Development Scenarios

	Northern Tract Group			Southern Tract Group		
Year	Direct & Indirect LRE–HRE	Induced LRE–HRE	Total LRE – HRE	Direct & Indirect LRE–HRE	Induced LRE–HRE	Total LRE – HRE
1982	0 – 0	0 – 0	0 – 0	580 – 580	120– 120	700– 700
1984	159 – 159	32 – 32	192 – 192	344 – 344	73– 73	417– 417
1986	464 – 464	96 – 96	560 – 560	116 – 116	24– 24	140– 140
1988	348 – 348	71 – 71	419 – 419	492 – 1733	218– 815	710–2548
1989	– –	– –	– –	– – 4209	– –1976	– –6185*
1990	347 –1344	178 – 643	525 – 1987	1313 – 3256	623–1583	1936*–4839
1992	1000 – 3441	487 –1658	1487*– 5099*	395 – 1943	237–1068	632–3011
1994	221 – 769	141 – 493	363 – 1262	243 – 948	156– 608	399–1566
1996	221 – 766	141 – 493	363 – 1262	243 – 902	156– 578	399–1480
2000	221 – 766	141 – 493	363 – 1262	243 – 877	156– 561	399–1438
2005	221 – 766	141 – 493	363 – 1262	243 – 877	156 – 561	399–1438

*Peak Year.

Source: BLM, 1980.

Table IV-10

Activity/Facility Employment Assumptions

Activity/Facility	Employment
Exploratory Drilling	133 per rig (rig year)
Development Drilling	65 per rig (rig year)
Temporary Service Base	Included with Exploratory Drilling
Operations Base	60 per platform undergoing development drilling + 68 for production $<$100 MBOPD; 136 for 100-200 MBOPD; 136 per 200 MBOPD for $>$200 MBOPD
Administrative Office	21 for $<$100 MBOPD; 42 for 100-200 MBOPD; 42 per 200 MBOPD for $>$200 MBOPD
Platform Production	22 per platform
Marine Terminal	17 per marine terminal
Gas Processing Plant	21 per 300,000 MCFGPD; 21 min.
Service Support Companies	12 per exploratory or development drilling rig

Source: BLM, 1980.

to provide goods and services would be attributed to OCS operations in the South Atlantic region. OCS related employment outside the local region should be substantial; however, the likely dispersed distribution of these jobs (primarily in Texas and Louisiana) should be such as to cause no substantial impacts.

The employment estimates in tables IV-9 and 11 do not include estimates of the number of workers required in the construction of onshore facilities. For the LRE development scenarios, only about 50 construction workers will be needed in each of the first two years of exploratory and development drilling phases; for the HRE development sceanrios, about 50 workers will be needed during the first two years of the exploratory phase, and between 500-700 workers will be needed at the beginning of the development drilling and production phase. Thus, this additional employment will not affect the peak year estimates shown in tables IV-9, 11, and 12.

b. Local Hire and New Resident Employment

Local hire and new resident employment are of special interest in the analysis of OCS related impacts. Local hire employment can help reduce local (and areawide) unemployment and underemployment in some instances, or it can contribute to local labor shortages or to an immigration of workers and their families seeking employment. New resident employment is of concern because it is these employees who move into a local area (in many cases with families) that can increase the demand for housing and other public and private services. The other employees are likely to cause less impact. The non-resident employees or commuters are presumed to generate most public and private service demands where they live, which is by definition outside the local impact area. And local hire workers who are already residents of the local impact area are also unlikely to create major new demands for facilities and services.

Estimates of local hire and new resident employment are presented in table IV-11. Local hire peak employment occurs in 1992 for the Northern Tract Group scenarios, ranging from 1,092 (LRE) to 3,728 (HRE). For the Southern Tract group scenarios, local hire employment reaches 1,393 (LRE) in 1990 and 4,417 (HRE) in 1989. Each of these peaks occurs during the height of the development drilling phase and lasts for only 1 year. In each ease the number of local hires increases rapidly over the 2-3 year period before the peak. After the peak is reached, total local hire employment experiences a very rapid net decline over a 2 year period before stabilizing.

New resident employment also peaks in 1992 for the Northern Tract Group scenarios, ranging from 398 (LRE) to 1,337 (HRE). Peak figures for the Southern Tract Group scenarios are 511 (LRE) in 1990 and 1,625 (HRE) in 1989. New resident employment experiences the same rapid growth followed by very rapid net decline as does local hire employment.

c. New Resident Population and School Enrollment Estimates

The new resident population generated by OCS related activity is perhaps the best indicator of the potential impact on the demand for public and private community services and facilities. Both the total growth and the period of time over which the growth is expected to occur (the rate of growth) are important in determining the potential impact on the community's economic and social well-being. The expected rate of growth is the most important indicator of the potential severity of impact. Experience in western state communities affected by energy development has shown that a population growth rate of over 10% per year will severely strain a community's ability to provide an adequate level of local services (ASPO, 1977).

The estimated new resident population generated by the proposed OCS lease sale is included in table IV-12. New resident population growth begins for the Northern Tract Group scenarios concurrently with exploration activity in 1984. This growth reaches an exploration phase peak of 146 in 1986, then declines until 1889 when it again increases concurrently with offshore development drilling activity and reaches a maximum in 1992 of 925 (LRE) to 3,083 (HRE); thereafter, it rapidly declines until stabilizing in about 1994. The same general pattern of growth, decline, and stabilization occurs in the Southern Tract Group scenarios. Exploration phase growth begins sooner (1982) and reaches a peak of 114 in 1984, then declines until 1987 when it again increases concurrently with the rapid expansion of development drilling employment and reaches peaks of 1,166 (LRE) in 1990 and 3,681 (HRE) in 1989; thereafter, it rapidly declines until stabilizing in 1994.

Usually the greatest impact related to new population growth is the concurrent increase in public school enrollment. Estimates of the amount of new resident school enrollment are included in table IV-12. Peak new

Table IV-11

Employment Impact
Estimated Local Hire and New Resident Employment

Year	Northern Tract Group Development Scenario: Local Hire Employment LRE — HRE	Northern Tract Group Development Scenario: New Resident Employment LRE — HRE	Southern Tract Group Development Scenario: Local Hire Employment LRE — HRE	Southern Tract Group Development Scenario: New Resident Employment LRE — HRE
1982	0 — 0	0 — 0	266 — 266	94 — 94
1984	72 — 72	26 — 26	161 — 161	58 — 58
1986	213 — 213	75 — 75	53 — 53	18 — 18
1988	158 — 158	56 — 56	481 — 1831	179 — 659
1989	— — —	— — —	— — 4417*	— — 1625*
1990	598 — 1440	149 — 601	1393* — 3565	511* — 1268
1992	1092* — 3728*	398* — 1337*	543 — 2442	176 — 805
1994	469 — 1150	158 — 336	360 — 1418	110 — 407
1996	325 — 1146	101 — 334	360 — 1355	110 — 384
2000	325 — 1144	101 — 333	360 — 1328	110 — 363
2005	325 — 1082	101 — 298	360 — 1328	110 — 363

*Peak year.

Source: BLM, 1980.

Table IV-12

Population Impact
Estimated New Resident Population and School Enrollment

Year	Northern Tract Group Development Scenario: New Resident Population LRE–HRE	Northern Tract Group Development Scenario: School Enrollment LRE – HRE	Southern Tract Group Development Scenario: New Resident Population LRE–HRE	Southern Tract Group Development Scenario: School Enrollment LRE – HRE
1982	0 – 0	0 – 0	182 – 182	63 – 63
1983	0 – 0	0 – 0	182 – 182	63 – 63
1984	51 – 51	18 – 18	114 – 114	40 – 40
1986	146 – 146	52 – 52	35 – 35	13 – 13
1988	107 – 107	38 – 38	410 – 1513	176 – 648
1989	– – –	– – –	– – 3681*	– – 1545*
1990	362 – 1232	164 – 529	1166* – 2935	493* – 1263
1992	925* – 3083*	402* – 1323*	459 – 2009	231 – 931
1993	– – 2426	– – 1070	– – 1212	– – 598
1994	395 – 910	186 – 459	298 – 1125	148 – 564
1996	278 – 910	140 – 459	298 – 1047	148 – 525
2000	278 – 907	140 – 457	298 – 989	148 – 495
2005	278 – 813	140 – 410	298 – 989	148 – 495

*Peak year.

Source: BLM, 1980.

school enrollment related to the Northern Tract Group development scenarios ranges from 402 (LRE) to 1,323 (HRE); for the Southern Tract Group development scenarios, it ranges from 493 (LRE) in 1990 to 1,545 (HRE) in 1989. The same pattern of growth and decline is experienced as was decribed previously for new resident population.

D. Environmental Impacts of the Proposal and Alternatives

1. Impacts on Significant Areas of Environmental Concern

Based on the consultation, coordination, and scoping meetings with Federal and state agencies, the public and other groups as discussed in Section V, an assessment was made of the potential environmental impacts which would result if this proposed sale were held.

The potential impacts were analyzed and nine were selected as being significant enough to address in Alternative A, Hold the Sale. They are:

a. Impact on Air Quality
b. Impact on the West Indian Manatee
c. Impact on Commercial Fisheries
d. Impact on Live Bottoms/Reef Areas
e. Impact on Community Services and Facilities
f. Impact on Recreational Fishing
g. Impact on Shoreline Recreation
h. Impact on Tourism
i. Impact on Water Quality

These potential impacts are detailed below as they relate to each alternative. Table IV-13 lists the resource and development estimates for the proposal and each Alternative B modification.

a. Impact on Air Quality

(1) Alternative A (Hold the Sale as Proposed)

Potential sources of atmospheric emissions which might significantly impact air quality in the sale area include offshore platforms, onshore facilities, and onshore population growth as a result of the sale. Emissions from harbor operations and boat traffic are not expected to make a significant addition to local air quality emission burdens. Anticipated operational bases, as identified in the development assumptions used for analysis, are expected to be in the Wilmington, North Carolina, and Brunswick, Georgia, areas.

Offshore platforms are not expected to exceed 56 in number, and will be widely scattered along a 450 mile long areas of the Atlantic Ocean from 16-111 miles offshore. Only 6 tracts are as close as 16 miles from shore; all others are at least 32 miles distance from shore. No more than 1 or 2 platforms are expected to be located on these 6 nearshore tracts. The following analysis examines the likely atmospheric emission contributions of these sources to the degree that they can be realistically evaluated based on past operating experience. Due to the prevailing wind patterns and offshore distances, air pollution sources offshore give no realistic indication that they will in any significant way combine with onshore effects. Volumetric dispersion, distances involved, and prevailing winds will prevent any such cumulative effect.

Offshore developmental activity will, at its maximum configuration, contribute to air quality degradation only in a very localized manner. The offshore platforms, generally widely dispersed, are not expected to be concentrated in any single location to any great degree. No more than 6 platforms are expected to be emplaced in proximity to each other in any tract group. The platforms operate at full machinery power during drilling operations only, and this is typically complete within about 2 years of platform emplacement. After that time, the wells are secured and flowing and only the power generation equipment and perhaps some pumps contribute exhaust gases. If we assume that all 1,299 estimated development wells are drilled, that the number drilled is equal per platform (23 wells per platform), and that the average hole depth is 10,000 feet, the quantities of pollutants produced per platform per day are: 138 kg nitrogen oxides (NO_x), 16.4 kg sulfur oxides (SO_x), 5.5 kg

Table IV-13

Resource and Development Estimates for the Proposal and Alternative B Modifications

Proposed Sale 56 (Alternative A)	Alternative B Modifications		
	B-1 Fisheries	B-2 Deep Water	B-3 Nearshore
Tracts - 286 (100%)	42(15%)	130(45%)	6(2%)
Wells - 461-1,400*	69-210	207-630	9-28
Platforms - 13-56*	1-8	5-25	1-1
Pipelines (mi.) - 140-540	21-81	63-243	3-11
Storage Terminals - 1-2*	0-1	0-1	0-0
Reserves (all tracts are oil/gas prone)*	O/G	O/G	O/G
Resources (5%-95%)			
Oil (bil bbls) 0.8-2.1*	0.12-0.31	0.36-0.95	0.01-0.04
Gas (tril.cu.ft.) 1.4-3.5*	0.21-0.52	0.63-1.57	0.02-0.07
Distances to shore (nmi) 16-111	32-57	32-111	16-23
Water depth (m) 20-2100	29-2100	490-2100	20-26

Sources: USGS, 1979 and BLM, 1979.
*USGS estimates.

1. All Alternative B (potential sale modifications), Pipelines, Distance to shore, and Water depth data, were estimated by BLM, N.O. OCS Office. Estimates are based on data in Table IV-1, and assumes all tracts share the resources and development about equally.

2. Potential sale modification for Alternative B-1, deletion of 42 fisheries tracts: Currituck Sound 1-5, Manteo 6-27, Russell 28-39 (crab, lobster, snapper/grouper habitat) and James Island 152, 156 and 160 (calico scallop areas).

3. Potential sale modification for Alternative B-2, deletion of 130 deepwater tracts: Currituck Sound 1-5; Manteo 7, 9, 11, 13 and 15-27; Russell, 28-33, 35, 36, 38, 39; Cape Fear 46-130 and Stetson Mesa 162-174.

4. Potential sale modification for Alternative B-3, deletion of 6 nearshore tracts: Beaufort 40-45.

hydrocarbons (HC), 14.4 kg carbon monoxide (CO), and 2.3 kg particulates. These quantities are based on data published by the EPA (1977) and have been averaged to account for typical drilling operations using either or both diesel-fired turbine or reciprocating engines. The typical hole depth from exploratory wells drilled as a result of Sale 43 is 6,000-7,000 feet. These amounts of emissions will increase air quality loading locally around platforms, then disperse to undetectable quantities within a few miles distance.

Gas venting, which is regulated to levels that prevent pressure accumulation in the drilling and production systems, may be continuous on wells encountering gas. EPA data (1977) indicates that no more than 0.5% of the total produced gas is vented or flared. If vented without combustion, the gas is largely methane; if combusted, there is a 99.5% reduction in hydrocarbons resulting in emissions of mostly CO_2 and water vapor, and minor amounts of carbon monoxide, sulfur oxides, and aldehydes. The total amounts of gas released or flared depends on characteristics of the oil and gas processing system, and the nature of the control techniques used. A worst case situation might be non-combusted venting of 0.5% of the total gas produced. On a per-well basis this would amount to 12,300 cubic feet per day. If combusted, this would contribute negligible amounts of nitrogen oxides and particulates, 98.4 g SO_x, 123 g HC, and 1,784 g CO. These quantities of these substances would also affect air quality conditions only locally.

A final offshore contribution to air quality degradation would occur in the event of a gas well blowout. There are no reliable estimates for volumes of gas lost during a "typical" blowout. USGS (1979a) records for such incidents do not estimate volumes of gas lost during historic blowouts. Blowouts recorded by the USGS (1979a) range in duration from 15 minutes to about a month or so. Most are of short-term duration measured in hours or days. EPA (1977) estimates that the volume of gas lost during a blowout may equal the daily production of gas for that well. If we assume the high daily peak production estimate of 841 million cubic feet of gas per day is attained, and that it is distributed among the high estimate of 1,299 wells, the daily peak production per well is 647,000 cubic feet. If a blowout was to occur, this amount of gas might be lost to the atmosphere each day. If a fire accompanied the blowout, most of this gas would be combusted to CO_2 and water vapor, to negligible amounts of NO_x and particulates, and to 5.2 kg SO_x, 6.5 kg HC, and 93.8 kg CO. These quantities of these substances would degrade air quality in the proximity of the blowout site but would disperse to undetectable levels within a few miles. As many as 6 blowouts may be expected to occur during the 30 year life of the field (Section IV.C.1.b.).

Significant onshore impacts are expected to occur as a result of operation of facilities, primarily gas processing plants, and as a result of population growth in the Brunswick, Georiga, and Wilmington, North Carolina, areas. Some impact on air quality may occur as a result of evaporative loss associated with terminal/storage facilities, but this is expected to be minimal. The EPA (1975) estimates 10.6 pounds of hydrocarbon emissions per 1,000 gallons of crude oil storage without reference to duration of storage. No NO_x, SO_x, CO, or particulates are emitted.

IR&T (1977) considered the environmental consequences of a gas processing plant being built in the South Atlantic region as a result of OCS oil and gas development. Their study included two scenarios of different levels of petroleum production and the resultant impact on several cities. They note that the pollutants of primary concern are sulfur oxides (SO_x) and that the degree of pollution will vary with sulfur content of the gas and degree of processing. They note that use of a Clause plant (to remove hydrogen sulfide) and a tail gas plant in combination remove up to 99.8% of the sulfur separated from the natural gas, and that in all their scenarios, sulfur oxides as a result of gas processing plants do not increase levels of sulfur oxide by more than 2%, as compared to a non-development scenario. Hard data on quantities of pollutants emitted are not presented, but their conclusion is that no significant impact on local air quality would result from the gas processing plants. EPA (1976, 1978) data do not include emission factors for gas processing plants.

Total population growth for the region is estimated to range from 925-3,083 persons as a result of OCS activities. If we assume a worst case situation, that all 3,083 persons settle in the same urban area, that each one owns a car, and that each car is driven 10,000 miles per year, the total annual emissions produced will be 95,600 kg NO_x, 6,200 kg SO_x, 89,400 kg HC, 709,100 kg CO, and 17,900 kg particulates based on EPA (1975) emission factors. In view of the relative absence of air quality problems in the region, no major air quality problems are foreseen. Recent information published by the EPA (43 FR 8962, et seq., published March 3, 1978 and 43 FR 40412, et seq., published September 11, 1978) on air quality emissions standards attainment status indicate that the only South Atlantic coastal counties with air pollution problems at time of publication were Charleston and Georgetown Counties, South Carolina; Chatham County, Georgia; and Duval County, Florida.

All onshore operations which will result from this proposal will be required to meet all federal, state, and local air quality standards. Current federal ambient air quality standards are summarized below. Offshore operations will be required to meet federal air quality standards if emissions from offshore operations affect onshore air quality. Additional information on air quality standards, emission sestimates, and air quality trends for the South Atlantic region are included in the final environmental impact statement for OCS Sale 43 (USDI, BLM, 1977).

Federal Ambient Air Quality Standards

Parameter	Standard Primary	Standard Secondary
Particulate Matter:		
Annual geometric mean	75 ug/m^3 1/	60 ug/m^3
24-hour maximum	260 ug/m^3	150 ug/m^3
Sulfur Oxides:		
Annual arithmetic mean	80 ug/m^3	— —
24-hour maximum	365 ug/m^3	— —
3-hour maximum	— —	1300 ug/m^3 (not to exceed more than once per year)
Carbon Monoxide:		
8-hour maximum	10 mg/m^3 2/	10 mg/m^3
1-hour maximum	40 mg/m^3	40 mg/m^3
Hydrocarbons:		
3-hour maximum	160 ug/m^3	160 ug/m^3
Nitrogen Dioxide:		
Annual arithmetic mean	100 ug/m^3	100 ug/m^3

1/ ug/m^3 = micrograms per cubic meter
2/ mg/m^3 = milligrams per cubic meter

Conclusion for Alternative A

It is not anticipated that air emissions from major sources resulting from Sale 56 will exceed federal or state air quality standards or that they will have more than a local impact on air quality. Only onshore, in the vicinity of processing facilities, will duration of emissions continue over the life of the field.

Cumulative Impact for Alternative A

OCS Sale 43 will be in development and production, should any finds of petroleum resources be made in Sale 43 tracts, for about 25 years. Forty-three tracts were leased as a result of Sale 43; these tracts combine with 98 Sale 56 tracts in the southern group of tracts about 27 miles off Brunswick, Georgia. Although this increases the number of tracts in that area by about 44%, the platforms are expected to be widely dispersed and to impact offshore air quality only in the immediate vicinity of each platform or group of closely sited platforms. Present experience indicates no significant onshore population growth and no present development of processing facilities as a result of Sale 43. Should finds on the order of the Sale 43 high resource estimates be made on Sale 56 tracts, 0-1 gas processing plant might be constructed and as many as 4,226 new residents might migrate into the area based on Sale 43 high resource and impact estimates. Even these additonal onshore emission sources would not be expected to cause insurmountable air quality problems, although should this impact occur in the four previously mentioned coastal counties, mitigating measures would probably be necessary to keep emissions below federal or state standards. The overall conclusion is that the cumulative air quality effects of these development activities will not be a major contributor to air quality degradation, either offshore or onshore.

(2) Other Alternatives

(a) Alternative B-1 (Deletion of Fisheries Tracts)

Implementation of Alternative B-1 would result in elimination of 15% of the proposed tracts and would reduce potential petroleum production by the same degree. This alternative would delete most of the northern, moderate deepwater tracts and so would significantly reduce the potential for impacts to the coast of North Carolina. The deepwater tracts remaining would probably be serviced by tankers rather than pipelines so onshore impact from facilities might be shifted to locations near the southern tracts, in the Mid-Atlantic region, or perhaps elsewhere. Onshore population growth would probably not be as great, especially in the North Carolina area, so that aspect of onshore impact would also be reduced. Offshore air quality degradation would center on the few nearshore and many offshore tracts and would be localized in the immediate vicinity of the producing tracts.

Conclusion for Alternative B-1

It is not anticipated that air emissions from major sources resulting from Sale 56 will exceed federal or state air quality standards or that they will have more than a local impact on air quality. Implementation of this alternative will reduce potential for any onshore impact in North Carolina. Offshore impact will be localized in the vicinity of the production platforms.

(b) Alternative B-2 (Deletion of Deepwater Tracts)

Implementation of Alternative B-2 would result in elimination of 45% of the proposed tracts and would reduce potential petroleum production by the same degree. This alternative would delete all of the northern group of tracts except for the 6 nearshore tracts and would delete the deepwater tracts located seaward of the existing Sale 43 tracts. Production resulting from the sale would be expected to be centered in the southern group of tracts and all onshore impacts would be expected to occur in that area. Probably no more than one gas processing plant would be constructed, perhaps in the Brunswick, Georgia area, and the greatest population growth would probably also be in the same general vicinity. Onshore impact for that area would be no greater than under Alternative A since most of the tract deletions affect the northern tracts. Offshore impacts would remain localized in the immediate vicinity of the producing tracts and would not affect onshore air quality.

Conclusion for Alternative B-2

It is not anticipated that air emissions from major sources resulting from Sale 56 will exceed federal or state air quality standards or that they will have more than a local impact on air quality. Implementation of this alternative will greatly reduce potential for any onshore impact in North Carolina but will not signficantly reduce potential for onshore impact associated with the southern group of tracts. Offshore impact will be localized in the vicinity of the production platforms.

(c) Alternative B-3 (Deletion of Nearshore Tracts)

Implementation of Alternative B-3 would result in elimination of only 2% of the proposed tracts and so would not reduce petroleum production by any great degree. This alternative would delete the 6 nearshore tracts southeast of Cape Lookout. The alternative would probably have no significant reduction in onshore impact, as compared to Alternative A. Offshore impact would remain localized in the immediate vicinity of producing tracts and would not affect onshore air quality.

Conclusion for Alternative B-3

It is not anticipated that air emissions from major sources resulting from Sale 56 will exceed federal or state air quality standards or that they will not have more than a local impact on air quality. Implementation of

this alternative will slightly reduce the potential for onshore impact in North Carolina and will not reduce the potential for onshore impact associated with the southern group of tracts. Offshore impact will be localized in the vicinity of the production platforms.

(d) Alternative C (Delay the Sale)

Implementation of Alternative C would delay the impacts described under Alternative but would not reduce the magnitude of impact.

Conclusion for Alternative C

It is not anticipated that air emissions from major sources resulting from Sale 56 will exceed federal or state air quality standards or that they will have more than a local impact on air quality. Implementation of this alternative would delay the impacts described under Alternative A but would not reduce the magnitude of the impacts.

(e) Alternative D (Withdraw the Sale)

Implementation of Alternative D would totally eliminate air quality impacts expected as a result of the proposed sale.

Conclusion for Alternative D

It is not anticipated that air emissions from major sources resulting from Sale 56 will exceed federal or state air quality standards or that they will have more than a local impact on air quality. Withdrawal of the sale would totally eliminate all air quality impacts projected as a result of the sale.

b. Impact on the West Indian Manatee

Section 7 consultations (Endangered Species Act, see Section I.D.2.b.) were held with the Fish and Wildlife Service and National Marine Fisheries Service pertaining to the proposed oil/gas leasing and exploration activities in the U.S. South Atlantic OCS region. The biological opinions resulting from these consultations are in Appendix B.

The biological opinions indicate that leasing and exploration activities associated with proposed Sale 56 are not likely to jeopardize the continued existence of the listed species considered in the consultations or result in the destruction or adverse modification of their critical habitats. However, the FWS biological opinion states that consultation must be reinitiated if there is any increased boating activity in areas of warm water discharge or congregation areas for manatees; or if vessels used in manatee habitats differ significantly in design from vessels which normally operate in those areas; or if new manatee concentration areas are discovered in routes used on a regular basis by vessels servicing offshore activities. Manatee habitat areas are depicted on visual 3.

(1) Alternative A (Hold the Sale as Proposed)

As a result of this proposal, offshore service vessels will make a total of about 1-3 trips/week (36-108 trips/year) from Brunswick/Savannah/Jacksonville harbors. This increased vessel traffic could cause manatee mortality due to collisions with these vessels. The rate of these vessel-manatee collisions has not been determined, but any increase in manatee mortality must be prevented.

To alert the lessees to this potential problem, BLM will include an "Information to Lessees" in the Notice of Lease Sale for proposed Sale 56 as follows:

> Bidders are advised that the West Indian manatee (sea cow) is a marine mammal which is officially listed as an endangered species by the Department of the Interior. It is protected by the Endan-

gered Species Act of 1973, as amended (86 Stat. 1027, 16 U.S.C. 1361-1407), and various other state and federal laws and regulations. On October 22, 1979 (44 FR 60963), Interior pormulgated regulations (50 CFR 17.100-17.108) providing a means for establishing manatee protection areas. Also, there is the Florida Manatee Sanctuary Act of 1978 declaring the entire State of Florida as "refuge and sanctuary for the manatee." A cooperative agreement between Interior and Florida on endangered species became effective on June 23, 1976. A similar cooperative agreement with the State of Georgia became effective on October 6, 1977.

The probability of one or more oil spills (greater than 1,000 bbls) occurring and contacting manatee habitat within the Georgia-Florida coastal area is 8-18% within 3-30 days, respectively, during the estimated production life (30 years) of this proposal. The highest oil spill risk area (land segment 18, table 12, Appendix D) is in the Brunswick, Georgia, area. Usually manatees are sighted in this area only during the warmer summer months.

Conclusion for Alternative A

As a result of this proposal there is an indeterminate chance of manatee mortalities as a result of collisions with offshore service vessels in Brunswick/Savannah/Jacksonville harbors. Currently, an estimate of the rate of vessel collisions with manatees has not been established, but any increase in manatee mortalities must be prevented. No adverse effects are expected as a result of oil spills.

Cumulative Impact for Alternative A

During the Sale 43 exploration phase, 1-3 trips/week were made by offshore service vessels from Brunswick, Georgia, with fewer trips from Savannah and Jacksonville. No vessel collisions with manatees have been reported as a result of Sale 43 activities, and therefore, no cumulative effects should occur as a result of this proposal.

(2) Other Alternatives

(a) Alternative B-1 (Deletion of Fisheries Tracts)

Alternative B-1 would delete three tracts within the James Island Area which could be serviced from Savannah harbor. The deletion of these tracts would have a negligible effect on offshore service vessel collisions with manatees.

(b) Alternative B-2 (Deletion of Nearshore Tracts)

Alternative B-2 — As the service area for these 6 tracts are outside manatee habitat areas, there would be no effect on manatees from this alternative.

(c) Alternative B-3 (Deletion of Deepwater Tracts)

Alternative B-3 would delete 13 tracts within the Stetson Mesa Area which could be serviced from Brunswick or Jacksonville harbors. The deletion of these tracts would probably have a negligible effect on offshore service vessel collisions with manatees.

Conclusion for Alternatives B-1, B-2, and B-3

Alternatives B-1, 2, and 3 will have a negligible effect on manatees as the majority of the potential deletion tracts will not be serviced from manatee habitat areas.

(d) Alternative C (Delay the Sale)

Delaying proposed Sale 56 would not have any significant benefits in the prevention of service vessel collisions with manatees.

(e) Alternative D (Withdraw the Sale)

Withdrawing proposed Sale 56 would prevent any potential service vessel collisions with manatees.

c. Impact on Commercial Fisheries Resources

(1) Alternative A (Hold the Sale as Proposed)

Table IV-14 lists the major groups of fisheries resources on the South Atlantic OCS. As can be seen from figure IV-4, anadromous fishes, reef fishes, and inshore and coastal shellfish are the groups most at risk from potential impacts caused by this proposal. The two potential impacts most likely to be of importance to fisheries are oil spills and platform and rig discharges.

The anadromous group is most susceptible to oil spills largely because they are exposed to several life stages, and their critical nursery areas are shallow shore waters and estuaries. Such areas more readily constitute effluent effects if polluting events occur in or near them. Anadromous fisheries are more abundant along the North Carolina coast than elsewhere in this area. However, even in North Carolina the likelihood of an oil spill reaching coastal inlets is very small. As can be seen from table 11 of the oil spill analysis (Appendix D), the expected number of spills impacting coastal inlets of North Carolina range from 0.0-0.2; this figure is from 0.0-0.4 for the entire area. Only three oil spills larger than 1,000 barrels are anticipated from the sale. The anadromous fisheries could be severely affected in a few localized areas if a large spill hit estuaries during the spring and summer; but the probability is extremely low. In any localized area where spills were to hit, the effects to be expected would be from loss of life in larvae to loss of equilibrium and loss of tendency to school. Many studies on eggs and larvae of various fish species (Atlantic cod, Pacific herring, pink salmon, sculpins, and others) have shown that various levels of the water soluble fraction of oil can affect the individual by killing the organism, arresting its development, or causing larvae from exposed eggs to be deformed.

Inshore fisheries, especially shellfisheries, have a high potential for impact because they live in enclosed bodies of water, and many of them have non-motile adult forms and cannot evade the stressing agents. Oil spills and pipeline construction operations present the greatest threat to inshore resources.

If an oil spill should enter an estuary, impacts of various degrees could result depending on the magnitude, extent, and duration of exposure to the spilled oil. A severe case could result in large mortalities of organisms including oysters, clams, crabs, and larval and juvenile fishes. Functional impairment could also result as well as uptake of petroleum hydrocarbons. Effects in the estuary can be expected to last from months to years. Impacts in an estuary would be highly visible compared to impacts offshore. But as we have seen, the likelihood of spills reaching these areas is extremely small.

If an oil spill strikes the coastline, the oil can accumulate and the effects can be intensified, but probably to a lesser degree than in estuaries. Motile organisms along the coastline have a greater chance of avoiding an oil spill than in estuaries where the escape routes, namely inlets, are few and may have a barrier of oil. It can be expected that oil would be more quickly dispersed along the coastline than in the estuaries because of currents and tides, especially in high energy areas. Mortalities and functional impairments to sessile fauna such as clams can be expected. Surf zone fishes will probably be able to avoid the spill and may be temporarily absent from areas of oil concentration. If the spill is extremely widespread, large areas of the shoreline could be affected, thereby reducing the fishing pressure in that area. The catch may be reduced, and fishing effort displaced to other areas.

Reef fishes generally congregate near natural reefs and live bottom areas (see also Sections III.B. and IV.D.1.d.). They also tend to congregate around structures and are probably the most susceptible to impacts from this proposal. OCS oil and gas operations have positive or enhancement impacts on reef fish in that platforms and pipelines function as artificial reefs, but also have a potential for adverse impact. Reef fishes around platforms are

Table IV-14

Major Groups of South Atlantic Fishes

FINFISH

Anadromous — sturgeons, river herrings, striped bass. Typically, adults make spring spawning migrations up rivers to spawn. Fairly short spawning season. Young found uprivers and in tidal areas of rivers. Adults typically in bays and even offshore. Do not exhibit the long coastwise migration that more northern stocks do.

Coastal *(Sciaenids)* — weakfish, seatrouts, croaker, spot, red drum. Widespread throughout area; adults occur in estuaries and nearshore areas. Adults spawn outside near inlets. Young utilize estuarine nursery. Protracted spawning times. Pelagic eggs and larvae.

Groundfish — hakes, butterfish, scups, flukes. These fishes over-winter in deeper waters of the continental shelf off Cape Hatteras. Species such as red hake spawn off Georges Bank south to New Jersey in the summer time. Most of the flatfish spawn over several months, and some species are spawning at any time of the year.

Migratory Pelagics — bluefish, king and Spanish mackerels, cobia, tunas, marlins. Many of these fishes are seasonally abundant in the area. Bluefish have protracted spawning throughout the area. The mackerels, tuna, marlin spawn farther south and in the Gulf of Mexico.

Coastal Herrings — primarily Atlantic menhaden. Adults of these fishes are generally found within 15 miles of the coast. The offshore waters south of Cape Hatteras appears to be a major over-wintering site. The spawning season is almost every month in some portion of their range. Eggs and larvae are pelagic. The young utilize estuaries as nurseries. The range of this species is along the entire U.S. east coast.

Reef fish — red snapper, red porgy, black sea bass, groupers. These fishes, as the name implies, are associated with reefs and reef-like structures. These fishes range throughout the area and the Gulf of Mexico. Most have protracted spawning times. The eggs are pelagic, and the larvae are thought to be pelagic at least for a short time. Some of the reef fish species are spawning at any season during the year.

SHELLFISH

Shrimp — pinks, browns, whites. These organisms exhibit an annual life cycle; the adults spawn offshore, the young utilize the estuarine areas as a nursery. Then as they mature, migrate back offshore to spawn. These range through the area.

Scallops — calico and sea scallops. The sea scallops range generally from Cape Hatteras north. The calico scallop occurs in scattered and unpredictable "beds" throughout the area. They are motile demersals. Eggs and larvae are pelagic.

Inshore Shellfish — crabs, oysters. These organisms occur in most of the bays and estuaries in the South Atlantic. Oysters are attached usually in aggregation. The eggs and early larvae are pelagic. Blue crabs are highly motile and move in and out of the estuaries.

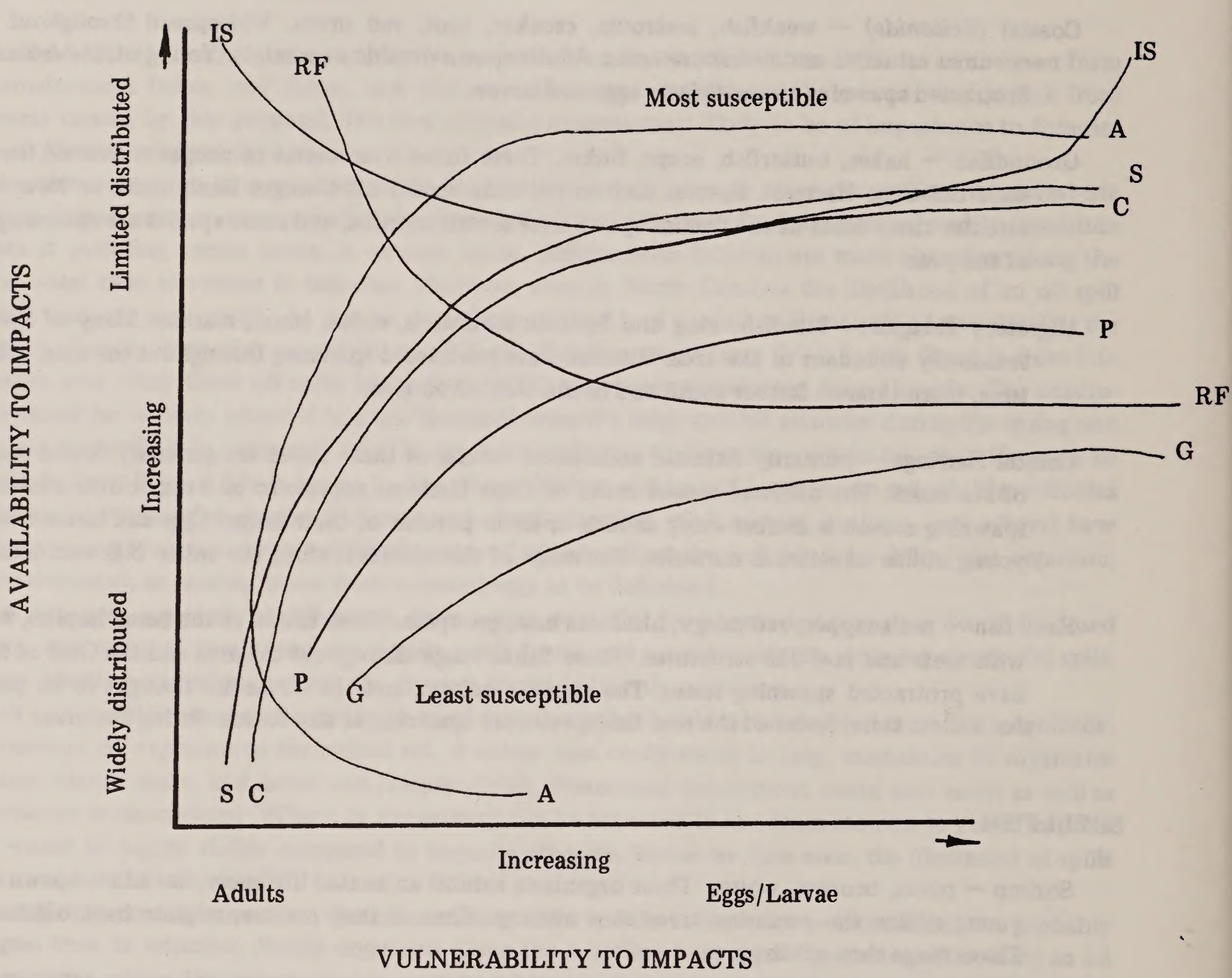


Figure IV-4 SUSCEPTIBILITY CURVES

A = Anadromous Fish
C = Coastal Sciaenids & Herrings
G = Groundfish
P = Migratory Pelagics
RF = Reef Fish
S = Shrimp
IS = Inshore Shellfish

constantly exposed to discharges. These discharges are discussed in detail in Section IV.C. This chronic exposure may not result in death to the organism but may involve functional impairment, which eventually may result in loss or diminished reproductive potential or capacity, and thus, a reduction in the number of recruits. As with impacts discussed earlier, the magnitude of the losses depends on the population dynamics of the particular stock, including density-dependent mortality and other compensatory phenomena. Currently, BLM has a study underway in the South Atlantic area to address the potential sensitivity of these livebottom areas (contract AA551-CT9-27). Because of regulations strictly limiting the quantities of pollutants that can be discharged, however, it is expected that the impacts to reef fishes will be small. Oil spills also present a risk to reef fishes; but because of the few number of spills expected, the impact is believed to be insignificant.

In summary, some estuarine resources may be impacted as a result of this proposed sale. The St. Simon's Sound, Georgia, area has the highest probability of being contacted by an oil spill. If the spill should enter and remain in the estuary, adverse impacts to fisheries resources could last from months to years. Probably the resource most affected would be the mollusc fisheries, especially oysters. If large mortalities result, restocking (cultching) may be required. In the short term (probably months), the commercial fishermen that derive their livelihood from that estuary will be severely impacted. This would be the oyster fishermen, crabbers, and mullet fishermen. This loss could partially be offset by changing to alternate fisheries or relocation of fishing effort to other estuaries. It is estimated that as a worst case 200 fishermen could be affected. There may be localized reduction in fishing effort for shore fishes if an oil spill should contact the shoreline. This especially relates to the North Carolina outer banks area. The probability, however, of an oil spill striking this area is low. The potential for adverse impacts on reef fisheries is difficult to predict. Oil and gas associated structures will provide additional habitat for reef fishes and can be considered a positive impact. The relationship between this positive impact and the potential negative impacts of sub-lethal stresses in unknown.

Conclusion for Alternative A

The risk to commercial fisheries resources caused by this proposal is considered to be relatively slight. Were a large spill to occur very near coastal waters during the spring or summer season, one or two localized areas would suffer some impact to local fish stocks, especially to larvae. The impact to the total population of the South Atlantic OCS should be small. Losses of one year class in one or two localized estuaries would be replaced by the larger coastal population. No species, populations, or even communities would be severely affected by this proposal. Rigs, platforms, and pipelines may enhance the reef fishery by providing additional hard bottom substrate.

Cumulative Impact for Alternative A

As described in Section I.E.1., only 6 wells have been drilled as a result of Sale 43 and additional operations are not planned. No hydrocarbon reserves were discovered, and fisheries resources were not affected. Because of this, there will be no cumulative impacts.

(2) Other Alternatives

(a) Alternative B-1 (Deletion of Fisheries Tracts)

Alternative B-1 would delete 42 tracts in which certain fisheries resources may be impacted. As discussed in Section II.B.1., however, it is believed that this modification will have little, if any, impact on the overall fisheries resources of the area.

(b) Alternatives B-2 and B-3

Alternatives B-2 and B-3 are not under consideration to protect fisheries resources; therefore, the adoption of any of these modifications will not alter the insignificant impact to fisheries except to reduce, to the extent that the deleted tracts contain fish or their habitat, even further the small local impacts due to specific drilling operations.

Conclusion for Alternatives B-1, B-2, and B-3

Adoption of Alternatives B-1, B-2, or B-3 will result in no significant change in the impacts to fisheries resources from those which would result from the proposal itself.

(c) Alternative C (Delay the Sale)

Alternative C will serve only to delay the above described small impacts for whatever period of time the sale were to be delayed.

Conclusion for Alternative C

This alternative will have the same impacts as the proposal.

(d) Alternative D (Withdraw the Sale)

Alternative D will eliminate these small, local, and ecologically insignificant impacts.

Conclusion for Alternative D

This alternative will eliminate any threat to fisheries resources of the U.S. South Atlantic OCS.

d. Impact on Live Bottom and Reef Areas

(1) Alternative A (Hold the Sale as Proposed)

As described in Sections I.C.2.b. and III.B., the biological stipulation to be imposed on each lease resulting from this proposed sale will serve to reduce impacts on sensitive live bottom and reefal area ecosystems (see Section IV.C.2.). The results of the surveys required by the stipulation will guide the USGS Supervisor in his decision on whether or not to permit a specific well location. It is anticipated that in most cases no well locations will be permitted within one nautical mile (nmi) of an identified live bottom area. It is conceivable that for various reasons (economics, location of the hydrocarbon formation, etc.) it may be necessary to drill a well closer to live bottoms than 1 nmi. If so, the Supervisor, with advice from USFWS, BLM, and the affected states, has several remedies available to reduce potential impacts. It is certainly true that the physical placement of a rig or platform and the disposal of drilling muds and cuttings in the ocean (if removal is not required) will have a severe impact on the individual organisms smothered, but this impact will be localized and will have no impact on species, communities, populations, or the ecosystem.

Nevertheless, unless drilling muds and cuttings are transported out of the area for disposal, a significant amount of material will be discharged into the water (Section IV.C.2.). For each "typical" well to 10,000 feet, about 511 yd^3 of cuttings and roughly 4,550 barrels of muds will be discharged (Otteman, 1976). This will cause some turbidity in the water for a distance of 1-2 nmi; most of these muds will settle to the bottom within 1 nmi in a layer too thin, it is believed, to alter the substrate and the organisms living thereon to any extent. The cuttings will form a low mound (about 20 cm high) right under or slightly down current of the discharge pipe, which itself is about 10 m under the water surface. To the extent that these cuttings represent a different substrate (i.e., different grain size) than the original bottom, these cuttings will smother the organisms originally there which will be replaced by organisms preferring the new substrate type. This area will be extremely small - on the order of 50 m or less in diameter. In this area it is quite likely that strong surrents will disperse the cuttings so much that any impact due to them will not even be noticeable.

Because of the depth of water, oil spills are believed to have no impact on live bottom areas.

It should be noted that rigs and platforms do serve as artificial reefs and are very quickly colonized by organisms quite similar to natural live bottom areas and serve the same function of thereby attracting commercial and sport fish species. Recreational fishing is quite heavy around platforms in the Gulf of Mexico after 30 years

of OCS oil and gas activity. This can be considered a beneficial impact which enhances the overall biological productivity of the area.

Conclusion for Alternative A

The impact on live bottoms and reefs, because of the stipulation that will be appended to each lease resulting from this proposal, is believed to be insignificant; such impact that does occur near such areas will be in a very small area and only for a very short time.

Cumulative Impact for Alternative A

As described in Section I.E.1., only six wells have been drilled as a result of Sale 43. Of those six, only one was determined, by operation of the biological stipulation and with the advice of the affected states, to be close enough to a live bottom area to require any additional restrictions. In this case, a monitoring plan was considered appropriate and was carried out by the lessee. The final report of this monitoring effort is not yet available, but it is safe to say that no major detrimental impact was seen. The results of the monitoring will be discussed in detail in the FEIS for this proposal.

Because of the little activity resulting from Sale 43 and the little, if any, impact to live bottoms resulting from that activity, there will be no cumulative impacts.

(2) Other Alternatives

(a) Alternatives B-1, B-2, and B-3

Alternatives B-1 through B-3 involve deletions of certain tracts. None of these deletions are being considered in order to protect live bottom or reefal areas; the biological stipulation to be applied to all leases resulting from the proposal will adequately protect these area. Therefore, the adoption of any of these modifications will not alter the insignificant impact to live bottoms and reefs, except to reduce, to the extent that the deleted tracts contain live bottoms, even further the small local impacts due to specific drilling operations.

Conclusion for Alternatives B-1, B-2, and B-3

Adoption of modifications B-1, B-2, or B-3 will result in no significant change in the impacts to live bottom and reefal areas from those which would result from the proposal itself.

(b) Alternative C (Delay the Sale)

Alternative C will serve only to delay the above described small impacts for whatever period of time the sale were to be delayed.

Conclusion for Alternative C

This alternative will have the same impacts as the proposal.

(c) Alternative D (Withdraw the Sale)

Alternative D will indeed eliminate these small, local, and ecologically insignificant impacts.

Conclusion for Alternative D

This alternative will eliminate any threat to live bottom and reefal areas of the U.S. South Atlantic OCS.

e. Impact on Community Services and Facilities

(1) Alternative A (Hold the Sale as Proposed)

During the scoping process many questions were raised and concerns expressed about the potential effect of OCS oil and gas development on local and regional employment and population, and the provision for community services and facilities. The potential impact of the proposed sale on employment and population has already been discussed in Section IV.C.4. This section addresses the potential impact on community services and facilities that could result from OCS-generated employment, population, and activities.

If the development of offshore oil and gas proceeds in the manner previously described in the Northern and Southern Tract Group development scenarios, substantial onshore activity will be generated. Service bases, marine terminals, processing plants, and related service support operations will increase employment opportunities, business activity, and income, and generate new resident population. These changes may slow or stabilize a declining population trend, or as in the case of the potential onshore development areas, they may contribute to a growth trend.

OCS-generated new resident population and business activity will result in increased demand for, and consumption of public and private community services and facilities such as education, police and fire protection, water supply, sanitary sewage and solid waste disposal, transportation, recreation, health care, energy supply, and housing. Such increases can result in temporary reductions in the quality of service and other adverse consequences (e.g., fewer and less frequent services, crowding and congestion of facilities, increased costs, shortages in supply, and fiscal balance problems). The severity of these potential adverse consequences is assumed to be directly proportional to the total increase in demand and the period of time over which the increase occurs, and inversely proportional to the capacity of existing service systems and facilities to meet increased demands without significantly lowering service levels.

As discussed in Section IV.C.4., new resident population growth is considered one of the best indicators of the potential impact on public and private community services. Both the magnitude and rate of growth are good indicators of potential impact levels. The relationship between new resident population growth and the demand for, and consumption of selected public and private services is presented in table IV-15, which shows the estimated peak year impacts of each development scenario. Peak new resident population growth for the Northern Tract Group scenarios ranges from 925 (LRE) to 3,083 (HRE); similarly, for the Southern Tract Group scenarios it ranges from 1,166 (LRE) to 3,681 (HRE). These figures are made more relevant by expressing them as estimates of increased demand for, or consumption of public and private services and facilities as indicated in the table. For example, the 3,681 new residents estimated to result from the Southern Tract Group (HRE) development scenario translates into an increase of 1,545 pupils enrolled in public school, 368-663 thousand gallons of additional water usage each day, 11 tons of additional solid waste each day, and the need for 1,625 housing units.

However, it is the potential consequences of such increases in demand and consumption in relation to specific communities that is most relevant. This analysis assumes that the seven potential onshore development areas discussed in Section IV.C.3. will be the location for all OCS-generated onshore development described in the Northern and Southern Tract Group development scenarios. Table IV-16 lists these onshore development areas along with the assumed maximum percentage of the estimated impacts indicated in table IV-15 that could occur for each area. The table also includes the peak OCS-generated population for each area as well as the average annual increase in population, the relative annual increase (average annual increase as a percent of the projected population of the area without the proposed OCS sale), and several other population impact indicators. It must be emphasized that these estimates are not predictions of the distribution of potential impacts; nor do they represent maximum impact scenarios for the Northern and Southern Tract Groups since the percentages add to considerable more than 100% for each scenario. A more likely allocation of these impacts among the development areas would reduce the indicated maximum percentage share of total onshore impact shown in table IV-16 by at least one third.

The percentage annual increase in population is one of the best indicators of the potential adverse effects on a community's public and private services and facilities. Studies have shown that population growth rates in excess of 10% per year create a significant strain on a community's ability to provide adequate services and facili-

Table IV-15

Estimated Population and Community Services/Facilities Impacts (Peak Year)

	Northern Tract Group Development Scenario LRE	Northern Tract Group Development Scenario HRE	Southern Tract Group Development Scenario LRE	Southern Tract Group Development Scenario HRE	Factors Used to Estimate Demand/Impact
New Resident Population (peak year)	925 (1992)	3,083 (1992)	1,166 (1990)	3,681 (1989)	a
Average Annual Increase (number years)	308 (3)	1,004 (3)	374 (3)	1,823 (2)	a
Peak Year Impact for Selected Community Services/Facilities:					
Educational Enrollment	402	1,323	493	1,545	a
Water Demand (million gallons per day)	0.093-0.167	0.308-0.555	0.113 -0.203	0.368-0.663	100-180 gal/day/person
Sewage (million gallons per day)	0.093-0.111	0.308-0.370	0.113 -0.135	0.368-0.442	100-120 gal/day/person
Solid Waste (tons per day)	2.75	9.25	3.38	11.04	6 lb/day/person
Housing Units (number)	396	1,337	511	1,625	1 per new resident employee

a — See Section IV.C.4.

Source: BLM, 1980.

Table IV-16

Potential Onshore Development Area Impact Indicators for Community Services/Facilities

Potential Onshore Development Area	Maximum % Share of Onshore Impacts	Projected Population[c] 1985	1990	Average % Annual Increase 1985-90	OCS-Generated Population (Peak) Total (Avg. Annual Inc.) LRE	HRE	Average % Annual Inc.[d] LRE	HRE	Proj. Pop. Average % Annual Inc.[e] (Base Case)	Combined Average % Annual Inc. (OCS generated + Base Case) LRE	HRE
Morehead City Area	100[a]	44,000	48,600	2.1	925 (308)	3,083 (1,028)	0.6	2.2	1.9	2.5	4.1
Wilmington Area	75[a]	170,000	197,100	3.2	694 (231)	2,312 (771)	0.1	0.4	2.8	2.9	3.2
Georgetown Area	25[b]	45,900	50,000	1.8	292 (97)	920 (460)	0.2	0.9	1.7	1.9	2.6
Charleston Area	75[b]	464,000	499,000	1.5	875 (292)	2,761 (1,381)	0.1	0.3	1.5	1.6	1.8
Savannah Area	100[b]	236,400	243,700	0.6	1,166 (389)	3,681 (1,842)	0.2	0.8	0.6	0.8	1.4
Brunswick Area	75[b]	62,300	68,100	1.9	875 (292)	2,761 (1,381)	0.5	2.1	1.8	2.3	3.9
Jacksonville Area	75[b]	680,000	726,000	1.4	875 (292)	2,761 (1,381)	0.0	0.2	1.3	1.3	1.5

a — Percent of Northern Tract Group development scenario impacts; b — Percent of Southern Tract Group development scenario impacts; c — Considered as base case projections without OCS development; d — Average annual increase to peak population as a percent of estimated development area population at beginning of increase; e — Average annual increase of projected population (base case) during period of OCS-generated population growth.

Sources: Berkeley, Charleston, Dorchester Council of Governments. 1978. Regional indicators. Charleston, SC: 21 p.
Berkeley, Charleston, Dorchester Council of Governments. 1979. OEDP, overall economic development program report. Charleston, SC: 87 p., App.
Coastal Area Planning and Development Commission. 1978. Areawide land use plan; coastal area (non-metropolitan). Brunswick, GA.
Coastal Area Planning and Development Commission. 1979. Overall economic development program for coastal Georgia, 1980-1984. Brunswick, GA: 239 p.
Jacksonville Area Planning Board. 1980. Letter/Response to questionnaire from U.S. Dept. of the Interior.
North Carolina Division of State Budget and Management. Update; North Carolina population projections. Raleigh, NC.
Waccamaw Regional Planning and Development Council. 1979. Population and economic study: Waccamaw Region. Georgetown, SC: 105 p.

ties (ASPO, 1977). Table IV-16 includes the combined percent annual increases in population (the base case on projected population without OCS development, plus the OCS-generated population) as well as its components. These figures show that OCS-generated new resident population growth in 5 of the onshore development areas (Wilmington-Southport, Georgetown, Charleston, Savannah, and Jacksonville) will be less than 1% per year, and that in the remaining 2 onshore development areas (Morehead City and Brunswick) the annual growth rate will be slightly more than 2% under the high resource estimate scenarios. More importantly, the combined percent annual growth rates are estimated at about 4% (HRE) or less. Again, the Morehead City and Brunswick areas have the highest estimated growth rates. These potential growth rates are less than half the critical 10% level and are not expected to create major problems with respect to the areawide provision of community services and facilities.

Revenues generated by OCS direct and induced activities are expected to be sufficient over the long-run to cover expenditures. However, some fiscal balance problems could arise because of the lag between the time that service needs arise and the time at which traditional revenue sources imposed on the new development and activity begin to produce corresponding revenue. There may also be imbalances between the communities in which the OCS-generated industrial facilities are located and the community in which the new residents reside.

It is expected that potentially significant adverse impacts related to the provision (and financing) of community services and facilities will be avoided entirely or substantially reduced through adequate management planning by state and local governments. All of the potential onshore development areas either have or participate in local and/or regional planning councils; in addition, the entire region is included in state coastal management programs. The objectives of these programs include orderly and efficient growth managment which minimizes community service, fiscal, and environmental impacts. In this regard, the Coastal Energy Impact Program (CEIP), in which state and local governments receive financial assistance in planning for and dealing with the fiscal impacts imports of OCS-related development, is expected to be an important mitigating factor.

Still it would be very unlikely that these maximum growth levels (or even lesser ones) did not create some problems, particularly for those smaller communities that might receive a relatively large share of the new resident population. But these problems are more likely to be routine, not extraordinary ones. A summary discussion of the general impacts and nature of problems expected in regard to the provision of public and private community services is included in the Summary Impact Assessment in Appendix F.

Conclusion for Alternative A

The direct requirements of OCS development activities, e.g., water usage, fire control, solid waste disposal, increased vehicular traffic, etc., are not expected to create significant local problems in the onshore development areas.

Increased demand for, and consumption of community services and facilities related to OCS-generated population is expected to be met without significantly lowering existing service levels and standards. At worse, these increased demands could contribute to a minor short-term (1-3 years) decrease in the quantity and/or quality of a community service in a particular local jurisdiction (the smaller communities would be more likely to experience this type of impact).

Cumulative Impact for Alternative A

OCS Sale 43 exploratory drilling which occurred in 1979 had a minimal impact on the communities in which onshore support bases were located (see discussion of OCS Sale 43 Activities in Section I.E.1.). The number of local hire jobs was small and the duration of employment short-term (6 weeks to less than 1 year). New resident population was also small and temporary. Rig service operations were provided with required community services without significant problems; other community service and environmental impacts were minimal.

On the basis of the poor results of the exploratory activity which took place in 1979, current indications are that any further exploratory effort will be minimal. It is therefore assumed that commercially recoverable petroleum, if found, would not result in a level of development and production activity that would significantly effect the offshore and onshore development scenarios used for this analysis (a level of activity/impact representing not more than 7% and 4% of the low and high resource scenario impacts, respectively, is assumed). Thus, the cumulative impact of proposed OCS Sale 56 would be essentailly the same as postulated and analyzed in this document.

(2) Other Alternatives

(a) Alternative B-1 (Deletion of Fisheries Tracts)

Alternative B-1 — This modification would preclude the occurrence of 30% and 2% of the potential impacts related to the Northern and Southern Tract Group (NTG and STG) development sceanrios, respectively.

(b) Alternative B-2 (Deletion of Deepwater Tracts)

Alternative B-2 — This modification would preclude the occurrence of 90% and 10% of the potential impacts related to the NTG and STG development scenarios, respectively.

(c) Alternative B-3 (Deletion of Nearshore Tracts)

Alternative B-3 — This modification would preclude the occurrence of 5% of the potential impacts related to the NTG development scenario.

Conclusion for Alternatives B-1, B-2, and B-3

These three alternatives are being considered for reasons other than their potential effect on the community service and facility impacts related to Alternative A. Still, it is evident that these modifications would preclude the occurrence of potential community service and facility impacts proportional to their share of the total tracts in each development scenario.

(d) Alternative C (Delay the Sale)

Conclusion for Alternative C

Potential impacts on the quality and provision of community services and facilities which might result from the implementation of Alternative A or B would be precluded from happening for an indefinite period of time.

(e) Alternative D (Withdraw the Sale)

Conclusion for Alternative D

All potential impacts related to holding the sale under Alternatives A, B, or C would be precluded from happening.

f. Impact on Recreational Fishing

(1) Alternative A (Hold the Sale as Proposed)

The major recreational activity which commonly extends out into the areas of the proposed 286 lease tracts is recreational fishing. Some recreational SCUBA diving activity is also directed at specific offshore areas. Most of this marine recreational activity is within 30 miles of shore and is associated with exceptional natural features (Gray's Reef for example), permitted artificial reefs, and charted shipwrecks. Many of these popularly recognized, site specific, offshore recreation destination areas are shown on visual 4. None of the existing, officially designated recreation destination sites are included within the 286 proposed lease tracts under consideration for Sale 56; therefore, no major land use conflicts are anticipated.

Experience in the Gulf of Mexico has demonstrated that oil and gas development offshore can significantly enhance deep sea or offshore recreational fishing (Ditton and Graefe, 1978; Dugas, Guillory and Fischer,

1979). It is widely accepted that oil and gas development platforms function as excellent artificial reefs attracting fish, and inevitably sport fishermen. Conventionally permitted marine artificial reefs constructed for recreational fishing are spatially limited to the benthic, and in some cases, mid-water zones. Oil and gas platforms provide an additional surface zone artificial reef, thereby concentrating the greatest possible array of marine niches consisting of bottom, pelagic, predator, and prey species.

There remains considerable professional debate on whether artificial reefs merely attract fish or actually stimulate fish production. Although both theories are likely to interrelate, recent studies (Stone, Pratt, Parker, and Davis, 1979) provide increasing support for a basic theory of wildlife management, that is, carrying capacity of any wildlife population is a function of habitat availability. Even though oil and gas structures minimally enhance habitat availability, they also can damage natural habitat during installation and pose some possible threats to existing habitat and associated marine life from effluents associated with the drilling and production activity, most notably from accidental oil spills. Recreational fishing commonly coexists with active drilling around Gulf of Mexico production platforms in the Gulf of Mexico; however, a major oil spill is likely to discourage recreational fishing in any area where the pollution is noticeable.

Oil and gas development platforms are easy to locate by recreational fishermen, provide a potential mooring and emergency assistance source, are navigation aids as well as obstructions, and are constructed and maintained at no direct cost to fishermen or the public agencies responsible for fishery management and development. The degree to which offshore oil and gas development will affect recreational fishing is believed to be related to the number and size of structures erected, the length of time they are in place, and the distance they are from shore and principal sport fishing access and market areas. Water depth, oceanic conditions, and bottom types around an offshore platform may also affect fishing.

The potential recreational benefits to fishermen are short term in that they will last only as long as a lease is productive (10-30 years). International accords and Federal regulations require removal of all structures upon termination of a lease; therefore, incidental recreational benefits will cease when energy production is exhausted.

Up to 56 permanent production life platforms could result from this 286 tract proposal. All but 6 tracts are located so far from shore that recreational benefits are likely to accrue to only large boat owners with the capability and affluence to safely travel 30 plus miles offshore. The charter boat industry, their clientel, and billfishermen are the most likely to be directly affected from this proposal. The billfish management plan estimates approximately 3,000 boats in this fishery (South Atlantic, FMC, 1979). Any such benefits, should they be realized, would not begin until around 1990.

Other activities associated with this proposal, such as onshore support facility development, transportation of people and supplies from shore, and transportation of commercially developed products to shore are expected to have minimal effects on marine recreational fishing.

Conclusion for Alternative A

This proposal should enhance recreational fishing potential offshore by creating artificial reefs which will concentrate sports fishing targets in the Atlantic Ocean within leased tracts which are ultimately developed (56 potential structures), especially those within 30 miles of shore (1 structure). Although short term adverse impacts from marine pollution events (3 oil spills and drill hole effluent discharges) and habitat modification may affect some fishing activity, the potential for sustained (up to 30 years) positive impacts are much greater.

Cumulative Impact on Alternative A

Should commercial finds from Sales 43 and 56 lead to additional oil and gas development interest in the South Atlantic area, a new recreational fishery could be developed in 8-10 years.

(2) Other Alternatives

(a) Alternative B-1 (Deletion of 42 Fisheries Tracts)

The deletion of these 42 tracts would have a minimal effect on recreational fishing because they are located too far offshore for recreational fishing.

Conclusion for Alternative B-1

No effect on recreational fishing.

(b) Alternative B-2 (Deletion of 130 Deepwater Tracts)

The deletion of these 130 deepwater tracts would not effect recreational fishing as they are too far offshore for recreational fishing purposes.

Conclusion for Alternative B-2

Alternative B-2 would not significantly change the impact of the proposal.

(c) Alternative B-3 (Deletion of Nearshore Tracts)

Should the 6 nearshore tracts within 30 miles from shore be removed from this proposal, the potential development of one high profile artificial reef accessible to most of North Carolina's offshore boat fishermen would be eliminated.

Conclusion for Alternative B-3

There would be a slight reduction in recreational fishing as a result of this option.

(d) Alternative C (Delay the Sale)

Conclusion for Alternative C

Delaying the sale would delay the potential development of up to 56 high profile artificial fishing reefs.

(e) Alternative D (Withdraw the Sale)

Conclusion for Alternative D

Withdrawing this sale would have no effect on the recreational fishing currently existing in the offshore area of the South Atlantic states.

g. Impact on Shoreline Recreation

(1) Alternative A (Hold the Sale as Proposed)

Offering 286 tracts from 16 to 111 nautical miles offshore will cause direct lease site activities and induced onshore support activities with marine and air transit in between. Axiomatically, offshore lease-site activity outside the visual perception of the coastal zone will not directly conflict with recreational resources or activities from the shorefront inland. Although the derrick portion of an oil and gas structure on the three tracts offered within 16-18 nm of Cape Lookout, North Carolina, may be within the visual limits of a portion of Cape Lookout National Seashore, such impact would be insignificant. More in-depth discussion of the visual impact from these three tracts is included later in this section.

Onshore support bases for exploration and development should require waterfront land, warehouses, dock and wharf space for storage, and transportation of people and supplies to the offshore exploratory rigs, and if successful, production platforms. It is estimated that between 1 and 4 exploratory rigs will be drilling offshore at any one time between 1982 and 1988. From 2 to 5 onshore bases associated with existing commercial ports such as Jacksonville, Savannah, Brunswick, Charleston, Georgetown, Wilmington or Morehead City are expected to

accommodate this temporary, or if production is eminent, more permanent onshore siting need. No recreational land losses are expected to result from these onshore support and supply bases because they will locate in existing commercial areas. Should commercial production ensue, two terminal/storage facilities may be required in the coastal zone of the South Atlantic between 1988-1991. With coastal zone management in effect, industry is most likely to locate such facilities in industrial parks or in commercially zoned land least likely to affect recreational areas and activities.

Marine and helicopter traffic entering and leaving the coastal zone in transit to and from rigs and platforms could cause minor aggravation to some forms of recreational activity. Boats make wakes and helicopters are noisy, so it is likely slight increases in commercial sea and air traffic in specific instances will be noticed, sometimes unpleasantly, by some marine recreational interests such as fishermen, boaters or waterfowl hunters. As work, supply and crew boats are most likely to travel existing commercial marine traffic lanes within coastal waters, and commercial and military air tráffic already exist in many South Atlantic coastal areas, conflicts with recreational interest will likely be the exception in isolated areas rather than the rule throughout the coastal plains area. Increased activity in inshore waterways and in the Atlantic Ocean will inevitably cause increased indiscriminate and accidental disposal of flotables (trash) into the marine environment, some of which will end up on shoreline parks, beaches and wildlife areas. Cumulatively, the effect of the debris associated with exploration and development activities from Sales 43 and 56 is not expected to be a major problem to any specific shoreline recreational area or activity.

Induced migration of residents, either temporary or permanent, would be gradual over a 1 to 10 year period, dispersed and probably insufficient to cause detectable impact on existing public recreational supplies and services. Assuming very optimistic success under the high resource estimate, several thousand (Section IV.4. b.) people could relocate to the South Atlantic region. Should this occur in a concentrated area in a short period of time, some impact on recreational services and supplies in such areas could be noted. Under the high find resource scenario, Morehead City and Brunswick are estimated to receive the greatest population stress (up to 6%) between 1987-1992. Regionally, there is an overall long range trend of population increase in the coastal areas of the South Atlantic; therefore, induced migration of permanent residents resulting from high oil and gas resource discoveries could exacerbate an existing situation.

If exploration is successful, development would lead to transportation of products which could require one or two pipeline landfalls in the South Atlantic coastal zone. Pipelines routed through the coastal area may traverse a shoreline recreation area and cause some temporary adverse impact. Experience at Padre Island National Seashore indicates that pipeline-beach crossings temporarily (2-3 weeks) removed 1,200 to 1,500 linear feet of shoreline from public beach use, but burial of the pipeline in the nearshore waters tended to attract sports fishermen. Recreational access and visual amenities are also affected when pipelines are constructed in the coastal zone. Most predictable adverse effects are temporary and associated with the construction phase; however, a pipeline crossing a barrier island and traversing a maritime forest could have a lasting visual impact.

By far the most feared adverse impact to shoreline recreation can result from oil released into the marine environment which finds its way into popular coastal recreation waters or reaches shore contaminating resources and discouraging recreational activities. Major oil spills can result from drill site accidents, tanker accidents, and pipeline failures. Factors such as the type of crude, wind, wave action, currents, exposure, and speed and effectiveness of containment and clean-up actions can affect the impact of spilled oil on recreation. Appendix C contains a comprehensive listing of the designated recreational-environmental areas and specific sensitive features and resources associated with those areas which might be affected by an oil spill coming ashore between Currituck County, North Carolina and Brevard County, Florida. This appendix can be directly correlated with tables 8, 9, and 10 and figure 6 of Appendix D for an indication of the spill impact risk to any specific shoreline area (county shorefront) from selected tract groupings or possible transportation corridors.

Appendix D, which includes a discussion on the mechanics and limitations of the spill model, provides risked probabilities of spills greater than 1,000 barrels launched from discrete lease site areas or transportation corridors contacting individual or selected grouping of recreation resource area targets existing along the South Atlantic seashore. In general, the model indicated that OCS lease Sale 56 will result in an expected 3 large (greater than 1,000 bbls) oil spills occurring off the South Atlantic coast of the U.S. The probability that one or more spills will occur and contact land within 3 days is 11%; for contacts within 30 days, the probability in-

creases to 50%. Risk to shoreline areas is distributed along the coastline, with most of the risk to North Carolina due mainly to the northermost tracts, and risk to other states due primarily to potential transportation routes.

Tables 2, 3, and 4 of Appendix D provide indications of the susceptibility of recreational resource areas to major oil spills starting from development possibilities resulting from offshore leasing. Oil spills reaching shore within 3 days from a source launching are likely to cause the most serious impacts. Should such a minimal probability (11%) occur that a short lived spill (3 days) comes ashore, there is up to a 17% chance any shoreline recreational areas will be affected (table 2). Potential transportation routes into major South Atlantic port areas account for most of this risk. When considering the 10 and 30 day spill conditions (tables 3 and 4), the most northern lease tracts pose the greatest relative threat (up to 27% chance of impact). Of the offshore North Carolina tracts those closest to shore (P3 and 4, figure 3, Appendix D) pose most of this risk. Tables 11-13, Appendix D, indicate that when considering existing leases (Sale 43) and ongoing tankering activities throughout the planning area, the incremental risk to shoreline recreational areas from oil spills posed by proposed Sale 56 is minimal.

Under the proposal there is a 50% chance that one major oil spill will affect a shorefront recreational area within the next 2-30 years. Risk to shorefront recreational areas is distributed all along the coastline with most risk to the North Carolina shorefront. The severity of the impact will be related to the spill condition, size, extent, location, and season of the year when it comes ashore.

Conclusion for Alternative A

This proposal is unlikely to affect the level of recreational use along the South Atlantic shorefront but will cause some intermittent pollution and modification to shoreline recreational resources. Most impact which does occur is expected to be minor and would be associated with pipeline landfalls, transit to and from offshore lease tracts, indiscriminate disposal of persistent flotables into the marine environment, population increases in concentrated areas, and oil pollution from offshore lease tracts and potential transportation development corridors. Impact from oil spills and trash will be short-term and considered a nuisance factor to shore based recreational activities. There is a slight chance, however, that some discrete shoreline recreational area(s) will experience a pollution incident sufficient to warrant temporary closure and displacement of recreational use.

Cumulative Impact for Alternative A

Even though Sale 56 doubles the risk of a major spill incident occurring offshore of the South Atlantic states, there is only a small incremental risk that shoreline recreational resources will be severely affected. The level of shorefront recreational use should be unaffected in the South Atlantic region as a result of this proposal and associated activities.

(2) Other Alternatives

(a) Alternative B-1 (Deletion of Fisheries Tracts)

Implementation of Alternative B-1 would eliminate 15% of the proposed tracts, and so might reduce the probability of oil spills and other impacts to the same degree. More specifically, this alternative would remove most of the northern group of tracts from the sale, and so would greatly reduce the probability of an oil spill and the other impacting factors discussed in the proposal affecting the coast of North Carolina.

Conclusion for Alternative B-1

This alternative would reduce the size of the sale and the probability of oil spills by 15%. More importantly, it would greatly reduce or eliminate the northern tracts, and so would greatly reduce the probability of pollution, pipelines, trash, and other minor impacts associated with the proposal from affecting the coast of North Carolina.

(b) Alternative B-2 (Deletion of Deepwater Tracts)

Implementation of Alternative B-2 would eliminate 45% of the proposed tracts, and so would reduce the probability of oil spills and other impacting factors to an even greater degree. This alternative would essentially eliminate any probability of pollution affecting the coast of North Carolina's shoreline recreational environment.

Conclusion for Alternative B-2

This alternative would greatly reduce (45%) the probability of pollution, pipeline landfalls, and flotable trash occurring in the North Carolina coastal area.

(c) Alternative B-3 (Deletion of Nearshore Tracts)

Alternative B-3 would delete the nearshore tracts within 30 miles of shore from this proposal. Appendix A lists six tracts (nos. 40-45) within this range.

Concern has been expressed about the aesthetic ramifications of nearshore oil and gas leasing to shoreline recreational areas and users. During ideal atmospheric conditions only three tracts (nos. 40-42) off the coast of North Carolina are within the outer limits of the visible range of shorefront recreational activity from the outer banks of North Carolina, which includes Cape Lookout National Seashore.

From figure IV-5 we note the possible shoreline perception ranges over the horizon. A park visitor out for a beachfront stroll after dark on the Cape during ideal atmospheric conditions could barely see the lights on the top of a drilling derrick situated in tracts 40, 41, or 42. These lights would provide virtually no visual contrast from a shore-based perception point, as it would probably be indistinguishable from stars over the horizon.

A drilling rig situated in the southwest extremity of tract 40 (closest possible lease site point to shore considered in this sale) would be within 13 statute miles of the shorefront at Cape Lookout. Although conceivably perceivable, the top of a drilling derrick in any proposed lease tract would not be readily visible to a 6 foot person on the beach at Cape Lookout during the day. It would probably be recognizable at times, however, in tracts 40, 41, or 42 by a person viewing the ocean horizon from the top of the Cape Lookout Light Station. This would only be possible when a drilling derrick is sticking up in the lease block during optimum weather conditions. As it takes approximately 30 days to drill an exploratory well, 12 exploratory wells may be drilled in tracts 40, 41, and 42 to define a hypothetical commercial discovery. Therefore, an exploratory rig's derrick could potentially be visible on location for approximately one year. Subsequently, one development platform could be installed on these lease tracts with its derrick in place for 1-2 years drilling development wells and for short periods thereafter when well workovers are required. Therefore, the recognizable daytime portions of an oil and gas structure would be visible, at most, for approximately 3 years and then only during very clear weather conditions and from the top of Cape Lookout Light Station. Such a sight may be considered an intrusion to some people, but is more likely to be a point of interest to most park visitors. In most instances, the viewer would probably be unable to distinguish the barely visible distant object from a ship unless assisted by artificial visual aids or interpretive aids.

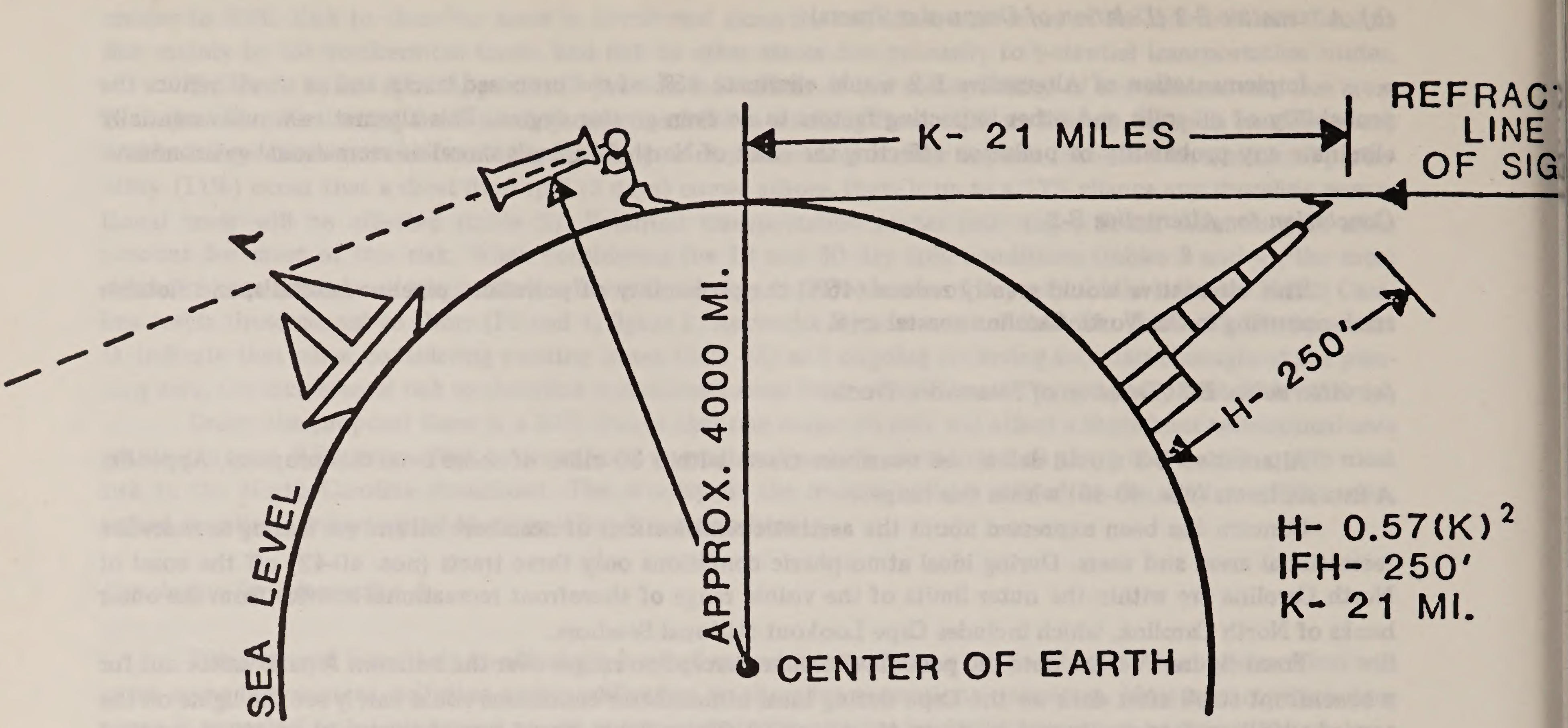
Deleting these six nearshore tracts would further decrease the already moderate to slight risk that shorefront recreational areas would be aesthetically impacted from lease site oil spills. Tables 2-4 (Appendix D) indicates area P-3, which encompasses the six tracts in this deletion option alternative, poses the greatest relative risk to parks and North Carolina beaches.

Conclusion for Alternative B-3

Eliminating the 6 tracts within 30 miles of shore would eliminate from the proposal the only lease site activity potentially visible from shore and reduce the oil spill impact risk (25% chance of impact from a 30 day old spill) to the beaches of North Carolina's outer banks area and Cape Hatteras and Cape Lookout National Seashores. Additionally, the risk of an oil spill reaching the coast of North Carolina within 3 days would be significantly reduced.

Figure IV-5

MAN'S VISIBLE LIMITS OF THE HORIZON (IDEAL CONDITIONS)



CURVATURE OF EARTH AND REFRACTION

FORMULA: $H = 0.57\ (K)^2$ where H is in feet, K is in miles.

1. A Man 6' tall can see a light 3.3 miles on the horizon at night, under ideal atmospheric conditions.

   $6' = 0.57\ (K)^2$; $K = 3.3$ miles

2. A light on top of a drilling mast on an offshore platform 250' above sea-level can be seen up to 21 miles under ideal atmospheric conditions. (At night)

3. A light on top of the Washington Monument (555 feet tall) can be seen for a distance up to 31 miles under ideal conditions at sea-level. (At night)

4. A Man 1750' above sea-level could see a light on a drilling mast 250' above sea-level, at night, under ideal atmospheric conditions up to a distance of 59 miles.

5. Daytime atmospheric conditions as a function of temperature, air density, heat waves, etc. would not permit such sights for any of the above.

Bob Murphy - Cities Service

(d) Alternative C (Delay the Sale)

Conclusion for Alternative C

Delaying the sale would delay the shoreline recreational impacts associated with the proposal.

(e) Alternative D (Withdraw the Sale)

Conclusion for Alternative D

Withdrawing the sale would eliminate all expected impacts to shoreline recreational activity and resources associated with the proposal.

h. Impact on Tourism

(1) Alternative A (Hold the Sale as Proposed)

During scoping one of the most vocal and consistently raised issue in every South Atlantic state was concern for the shorefront beaches and how oil and gas development in the ocean off the South Atlantic coast would affect tourism. Tourism is a major growth industry in the coastal plains region and the primary industry in many shorefront coastal counties and communities. The following discussion of tourism addresses the reacreational use of shoreline facilities and beaches.

The proposed leasing of 286 offshore tracts outside the visible range of shorefront tourist communities (see Section IV.D.1.g.(2). for visual resource assessment of nearshore tracts) should have little or no direct impact on coastal tourist economies where the primary attraction(s) are removed from the ocean and its shorefront. The historical and cultural aspects of Charleston and Savannah, for example, should be unaffected by this proposal.

Shorefront tourist destination areas where the primary attraction is directly associated with the ocean and its shorefront beaches (Section III.C.8., visual 4 and Appendix C) are susceptible to major and minor impacts from large oil spills related to exploration, development or transportation of offshore oil and gas.

Should there be a large oil spill as a result of this lease sale, impact to tourism along the eastern seaboard can be derived from the physical damage caused by oil coming ashore and the psychological effect of the publicity and emotionalism associated with the incident.

Table 1, Appendix D, indicates we can expect from one to three major spills ($>$ 1,000 bbls) if Sale 56 leads to successfully leasing all 286 tracts under consideration in this proposal. This is estimated to potentially double the major oil pollution incidents which are likely to occur without this proposal as approximately 3 additional major spills are expected from ongoing tankering activities.

It is important to realize oilspills have and are likely to continue affecting the South Atlantic marine environment. Studies by Dennis (1959) and Morris (1973) have documented the occurrence of petroleum residues, commonly referred to as "tar balls," as a chronic problem in the Atlantic Ocean which is affecting Atlantic coastal beaches. Most of this is believed to be derived from commercial shipping. Widely dispersed tar balls can and have been a nuisance to public recreation associated with South Atlantic tourist beaches.

Historically offshore production has been a minor contributor to the overall problem of marine oil pollution in the U.S. The following figures on the sources of oil pollution to U.S. waters in 1977 exemplifies this:

OIL SOURCE	% OF TOTAL
Tank ships	55.7
Pipelines	14.2
Tank barges	8.9
Land vehicles	3.0
Onshore bulk storage	3.0
Onshore/offshore bulk cargo transfer	2.4

Onshore production	0.5
All other shipping vessels	1.5
Offshore production	0.5
Onshore refining	0.4
Miscellaneous/unknown	8.6
TOTAL - 17.6 million gallons	100%

Source: U.S. Department of Transportation, 1978.

Understanding physical impacts of existing oil pollution sources in the South Atlantic and elsewhere will help visualize and put into context what may be expected from offshore leasing should major accidents occur.

Should this proposal go forward there is only a small (11%) probability that a major spill will affect the shoreline of the South Atlantic in 3 days should all the tracts be leased (Appendix D). The short lived spills can cause the most dramatic physical adverse impacts most likely to have a major impact on tourism. Current technology does not lend itself to efficient containment of spilled oil in the open ocean under normal conditions; therefore, such a spill would be a somewhat consolidated unit minimally affected by weathering and ocean dynamics, and appear on a beach as intermittent pools of liquid petroleum. Such an event would physically preclude recreational enjoyment of the beach in the area affected and would result in a temporary closing of beachfront areas until clean up is completed. Should publicity be minimal and non-dramatic, the cost to the tourist economy would be localized and minimized with very little, if any, regional ramifications. Several such incidences have affected the outer banks area of North Carolina in years past, forcing the National Park Service to temporarily close portions of Cape Hatteras National Seashore for clean up. Some economic impact to nearby coastal communities has been documented and can be expected when instances of this nature occur. When tourist beaches are polluted with crude oil, disposal and replacement of contaminated sand is another onerous problem which must be considered.

The Santa Barbara oil spill of 1969 resulting from a blowout on a development platform located within 6 miles of shore was the most damaging incident ever recorded from U.S. offshore operations. The regional tourist economy was severely impacted from this major oil spill. Damage assessments varied but settlement cost amounted to $13.7 million, some of which was compensation for damage to tourist related enterprises. Mead and Sorensen (1970) estimated a loss of 744,000 beach visits in a two county area in the year following the Santa Barbara incident. Although a duplication of the Santa Barbara situation is considered extremely remote on the east coast from this proposal, such impacts have occurred and may be conceivable in a frontier area. It is important to note, however, that even in this historical worst case, the damage to the tourist economy was temporary and compensated.

As stated earlier, severe, extensive beachings of oil masses would most likely be associated with a short lived spill. Table 1, Appendix D, indicates there is a small (11%) chance that any spill resulting from this proposal will ever come ashore within 3 days. Should this occur, table 2 indicates virtually no probability that tourist beaches in Florida, Georgia, and South Carolina will be affected should the spill source originate in a lease tract. North Carolina beaches have a 2% probability of being affected and then only if the spill source is from the nearshore tracts. Possible development scenarios involving pipeline landfalls and transshipment barging routes increase severe impact vulnerability to tourist beaches in Florida and Georgia. When considering longer lived spills (10 and 30 days, tables 3 and 4), indications are that the nearshore tracts off North Carolina and potential transportation corridors to shore are the most likely spill source locations that would affect tourism destination beaches along the eastern seaboard. Vulnerability of any specific beachfront tourist destination area from lease sites or potential transportation corridors can be extrapolated from tables 5-10, Appendix D.

Table 11, Appendix D, indicates tourist beaches in Florida and South Carolina will probably be unaffected by the actions resulting from this proposal. North Carolina has a 1% probability that some pollution incidence will affect its tourist beaches, and Georgia tourist beaches have an 8% probability of being impacted. Georgia's greater relative risk is associated with transportation possibilities to Savannah and Brunswick.

Oil spills, or for that matter east coast offshore oil exploration, are highly emotional issues of national concern. Therefore, should a large spill occur anywhere it is likely to be widely publicized. Such publicity has been known to affect tourist economies regardless of the final fate of major spills. In August of 1979, the oil spill

off Mexico began its noticeable economic impact on Texas' beach communities. This was approximately two weeks before major pollution impacts had occurred (Brooks, 1979). It is possible, therefore, some impacts could be experienced to the tourist economy throughout the coastal plains region should any major sustained spill event occur, especially during the spring or summer.

Conclusion for Alternative A

Should this sale proceed as proposed the risk that oil pollution will damage the tourist economy of the South Atlantic seaboard will increase. At least one major oil pollution event is likely to impact tourist beaches in Georgia or North Carolina. Such an incident, should it occur, is most likely to be associated with transportation of crude oil discovered and caused a temporary decline in recreational use of affected shoreline areas. Decline in recreational use would lead to a loss of tourist revenue. The impact should be localized and short term with only mild economic consequences but could become regional in scope and more economically damaging depending on the beaching location, size, duration, nature and season of the spill, and publicity associated with a major pollution incident.

Cumulative Impact for Alternative A

Although Sale 56 could cause a short-term decline in the tourism economy tied to some portions of the South Atlantic shorefront, some risk already exists and will continue from tankering activities and the potential development of Sale 43 tracts leased in 1978. Although tankering of crude oil is not likely to increase in the foreseeable future, large finds of crude oil off the east coast could ultimately reduce foreign tankering which is currently a greater threat to tourism than offshore development on the U.S. outer continental shelf.

(2) Other Alternatives

(a) Alternative B-1 (Deletion of Fisheries Tracts)

Implementation of Alternative B-1 would eliminate 15% of the proposed tracts, and so might reduce the probability of oil spills and other impacts to the same degree. More specifically, this alternative would remove most of the northern group of tracts from the sale, and so would greatly reduce the probability of an oil spill affecting the coast of North Carolina.

Conclusion for Alternative B-1

Deletion of these 42 fisheries tracts would reduce (approximately 15%) the potential impact of this proposal on tourism in the North Carolina coastal area.

Alternative B-2 (Deletion of Deepwater Tracts)

Implementation of Alternative B-2 would eliminate 45% of the proposed tracts, and so would reduce the probability of oil spills to an even greater degree. This alternative would essentially eliminate any probability of an oil spill affecting the coast of North Carolina.

Conclusion for Alternative B-2

Deletion of these 130 deepwater tracts would significantly reduce (approximately 45%) the potential impact of this proposal on tourism in the North Carolina coastal area.

Alternative B-3 (Deletion of Nearshore Tracts)

Implementation of Alternative B-3 would eliminate 2% of the proposed tracts. The only significant reduction in impact to be attained by this alternative would be a lesser probability of an oil spill reaching the coast of North Carolina within 3 days.

Conclusion for Alternative B-3

Deletion of these 6 nearshore tracts would reduce (approximately 2%) the potential impact of this proposal on tourism in the North Carolina coastal area.

(d) Alternative C (Delay the Sale)

Conclusion for Alternative C

The risk to the tourist economy associated with the proposed action which could cause temporary declines in tourist related recreation use would be delayed should the sale be rescheduled for a future date.

(e) Alternative D (Withdraw the Sale)

The withdrawal of this sale would eliminate any threats to the South Atlantic tourist economy derived from oil spills in the 286 tracts included in the proposed action. Consequently, the potential development of an estimated 300 billion gallons of gasoline (assuming 50% of a barrel of crude is converted to gasoline) would be foregone. When personal fuel supplies are insufficient or too expensive to meet the expected demands of the American public, the tourism industry has been known to suffer as was demonstrated in 1973 and 1979. On the positive side, insufficient supplies also generate support for research and development into energy alternatives and conservation which could change our travel habits and ultimately be environmentally advantageous.

Conclusion for Alternative D

Withdrawing the sale would remove the impact of sale related oil spills which could temporarily cause declines in portions of the South Atlantic shore based tourist economy.

i. Impact on Water Quality

(1) Alternative A (Hold the Sale as Proposed)

The major impacts to water quality resulting from the proposed sale will come from offshore platform operations, including disposal of muds and cuttings, discharges of routine effluents and produced waters, and from occasional oil spills; from resuspension of sediments during pipeline emplacement and spills from occasional pipeline breaks or leaks; and from onshore operations bases, terminal/storage facilities, gas processing plants, and increased quantities of municipal sewage from induced population growth.

During routine exploratory and production drilling, drilling muds and cuttings may be discharged if the muds are water-based and their discharge does not result in free oil on the surface waters. Muds that are oil-based may not be discharged. OCS Order No. 7 requires that a drilling mud report be included in exploration or development plan applications to the USGS. Discharges in the vicinity of sensitive biological areas may be prohibited or otherwise regulated. Drilling muds are composed primarily of nontoxic barium sulfate (barite), natural bentonite clays, and fresh or seawater. A variety of "minor constituents" are added to regulate the desired characteristics of the mud; these range from nontoxic to severely toxic. In general, the more toxic components are present in very small proportions (measured in parts per thousand).

During routine drilling to 10,000 feet hole depth as much as 3,400 barrels of drilling muds and 391 m^3 of cuttings may ultimately be discharged overboard (table IV-17). Drilling as a result of OCS Sale 43 was typically to 6,000-7,000 feet hole depth. Our assumptions for environmental analysis are that between 361 and 1,400 wells will be drilled as a result of Sale 56, including both exploratory and development phases. This would result in the discharge of approximately 1.2-4.8 million barrels of drilling muds and 141,000-547,000 m^3 of drill cuttings. These materials would be discharged from about 101 exploratory drilling operations and 13-56 widely dispersed platforms. Discharge of these materials may result in a discharge plume. Plumes as long as a mile have been reported in the Gulf of Mexico. Recent informaton indicates that suspended sediments in the plume disperse volumetrically to "background" levels within about 1 km of the discharge point during routine, nonbulk discharges

Table IV-17

Volumes of Drilling Muds Used and Drill Cuttings Generated in Drilling to 10,000 and 18,000 Feet

Interval Below Mudline (Ft.)	Drilling Mud Type	Bore Hole Diameter (Inches) 10,000 FT	Bore Hole Diameter (Inches) 18,000 FT	Total Mud Volume Including Hole Volume (BBLS.) 10,000 FT	Total Mud Volume Including Hole Volume (BBLS.) 18,000 FT	Total Volume of Cuttings Removed From Hole (m^3) 10,000 FT	Total Volume of Cuttings Removed From Hole (m^3) 18,000 FT	Total Weight of Cuttings Removed From Hole (MT) 10,000 FT	Total Weight of Cuttings Removed From Hole (MT) 18,000 FT
0-150	Seawater and natural mud	36	36	As required		30	30	65	65
150-1,000	Seawater-gel natural mud	25	32	As required		83	135	184	301
1,000-4,500	Seawater-gel Lightly treated mud	18	20	1,800	2,200	175	216	406	484
4,500-10,000	Seawater/fresh-water - lignosulfonate mud	11	-	1,600	-	103	-	247	-
4,500-12,000	Seawater/fresh water-lignosulfonate mud	-	15	-	2,800	-	261	-	626
12,000-18,000	Freshwater lignosulfonate mud	-	10	-	2,000	-	93	-	238
TOTAL				3,400 bbls.	7,000 bbls.	391 m^3	735 m^3	902 metric tons	1,714 metric tons

Modified from USDI, BLM, 1977, p. III-2.

(Ayers, et al., 1980; Shinn, et al., 1980). The final environmental impact statement for OCS Sale 58 (USDI, BLM, 1979) includes a review of drilling fluids usage and disposal on the OCS.

Planktonic organisms passing through the discharge plume may be adversely affected, both by the non-toxic suspended sediments and by the toxic dissolved minor constituents. The area of effect should be confined to within 1 km of the platform, in view of dilutions involved. No significant impact to the regional plankton communities or fisheries resources are anticipated in view of the relatively minute areas of potential impact, as compared to the entire OCS area. Experience in the Gulf of Mexico has not shown any apparent adverse impact on fisheries resources due to larval mortalities or sublethal consequences of muds and cuttings discharges.

Drill cuttings are expected to settle out of the discharge plume in the vicinity of the platform. These cuttings are natural rock materials saturated with formation waters (i.e., "fossil seawater"), and are not expected to induce any toxic effects on benthic organisms. Due to natural working and reworking by both physical and biological processes, cutting piles tend to disappear within a few months after cessation of drilling activities.

Routine effluents discharged during offshore operations include deck drainage and sanitary effluents. Neither of these is expected to exceed a few tens to hundreds of barrels per day, and because of open-water dilutions with distances from discharge site, no significant impact is expected. EPA effluent limitations regulate the permissible levels of oil and grease in discharged waters from deck drainage, etc., to 30 mg/l. Target chlorine residual for sanitary treatment effluents is 1 mg/l. The impacts of these concentrations of these substances on receiving water quality will be minimal, and will be confined to an area within a few meters of the discharge site.

In addition to these effluents, as much as 7,000 barrels of produced formation waters may be discharged per 10,000-foot hole. The constituents of concern in these waters are entrained liquid hydrocarbons, dissolved mineral salts, dissolved radionuclides, and an absence of dissolved oxygen. These waters would be discharged at an average rate of about 15 barrels per hour. In general, formation waters have been shown by experience to be relatively innocuous, and disposal of treated (to remove oil and grease) formation water is not expected to cause significant water quality degradation.

The most significant impacts on water quality offshore will result from oil spills. Generic and estimated specific impacts of oil spills are considered elsewhere, so will not be reiterated here. As many as six oil spills of 1,000 barrels or more are predicted by oil spill risk analysis model (Appendix D) as a result of OCS Sales 43, 56, and existing transportation. As many as three, but more likely only two of these spills may occur as a result of Sale 56 alone. On a simple proportional basis using production data from the Gulf and Sale 56 estimates for comparison, approximately 750 to 2000 barrels of oil spillage per year are projected (Section IV.C.1.a.). The final environmental impact statement for OCS Sale 58 (USDI, BLM, 1979) contains a good review of the influences of petroleum hydrocarbons on the marine environment.

Impacts of water quality attributable to pipelines will derive from benthic sediments suspended during pipeline emplacement and burial activities, and from occasional breaks or leaks resulting in oil spills. Gas pipeline leaks will cause elevated levels of methane in the water, but no severe environmental consequences. Much of the methane is quickly lost to the atmosphere, the remainder is diluted throughout the water mass.

As pipelines are emplaced, the underlying substrate is jetted away so that the result is placement of the pipeline in a trench, with burial following as a result of natural redistribution of surficial sediments. The width of the trench jetted will vary with sediment type. For purposes of estimation, a trench roughly 2 meters deep by 4 meters wide with a parabolic cross-section will result in resuspension of 1,400-3,800 m^3 of sediment per km. A turbidity plume may result, perhaps as large as several meters wide and hundreds of meters long if the sediment contains much mud or clay. The size and duration of the plume will depend on the size, shape, and density of the sediments suspended and water turbulence. This increase in turbidity will create a short-term impact on water quality in coastal waters. This impact will be limited in area to a few hundred meters from the pipeline, and in time to a few days or so. No significant long-term impact is expected.

Spills were discussed above. The oil spill risk analysis model does not differentiate among the various sources of potential spills, so the number that may be due to Sale 56-related pipeline breaks can not be deduced from the spill model analysis. As noted above, as many as six spills may occur in the region as a result of OCS Sales 43, 56, and existing transportation.

IR&T (1977) analyzed environmental consequences of proposed offshore oil and gas development in the South Atlantic area, including impacts of operations bases, terminal/storage facilities, gas processing plants, existing refineries, and municipal sewage increases as a result of regional population growth. They concluded that

projected increases in major categories of effluents (biochemical oxygen demand, suspended solids, dissolved solids, nitrates, and phosphates) were not significant in the scenarios and counties considered. Their scenarios were not the same as the assumptions for this environmental analysis, but were of similar scope. The largest impact on water quality parameters was generation of phosphates and nitrates from municipal sewage as a result of population growth. This increase was only in the range of only 0-6%, however.

All onshore facilities will come under state jurisdiction in regard to effluent discharges. The Water Quality Management Plans required under the Federal Water Pollution Control Act (P.L. 92-500) for each respective state provide baselines for the present water quality for each hydrologic basin. Depending on the location of the onshore facility, mathematical models can be calculated for that particular basin and the water quality of the area can be determined. Since these facilities are located onshore, effluent discharges are regulated by the State Water Quality Boards under EPA guidelines. The final environmental impact statement for OCS Sale 43 (USDI, BLM, 1977) discusses water quality of the various basins in the sale area.

Conclusion for Alternative A

Routine offshore operations will cause only minimal water quality degradation which will be measurable only within a 1 km distance from the platforms. Oil spills may severely degrade water quality, especially if they move into shallow coastal waters. Two or three major spills (1,000 barrels or greater) are expected to occur as a result of Sale 56. Onshore impact will be localized near terminal or processing facilities, will be of relatively short-term.

Cumulative Impact for Alternative A

Routine offshore operations will cause some water quality degradation in the immediate vicinity of platforms. Onshore impact will consist primarily of minor increases of facilities effluents and domestic sewage. The most severe impacts will result from oil spills. As many as six oil spills are predicted by the oil spill risk analysis model as a result of Sales 43, 56, and existing transportation. Water quality effects in localized areas will be moderate, but of temporary (+25 years) duration.

(2) Other Alternatives

(a) Alternative B-1 (Deletion of Fisheries Tracts)

Implementation of Alternative B-1 would result in elimination of 15% of the tracts proposed for sale, primarily those in the northern groups of tracts along the edge of the continental shelf (groups P1, P2, P4 and the innermost tracts of P7 of the oil spill risk analysis model). This would eliminate about 15% of estimated exploration and production, so would eliminate discharges of effluents that would have been associated with those activities. The probabilities of an oil spill would also be reduced, and the potential for impact along the North Carolina coast would especially be reduced. Potential onshore impacts, especially those projected for North Carolina, would also be reduced. However, as noted above, routine offshore operations are not expected to significantly degrade water quality except in the vicinity of the drilling operations and onshore impact is projected to be minor increases in municipal sewage loading.

Conclusion for Alternative B-1

Routine operations associated with the proposed sale are not anticipated to produce significant adverse water quality impact, either offshore or onshore, regardless of whether or not this alternative is implemented. However, oil spills that may result from the sale may cause severe short-term water quality degradation, especially in coastal areas.

(b) Alternative B-2 (Deletion of Deepwater Tracts)

Implementation of Alternative B-2 would eliminate 45% of the proposed tracts from sale, including all tracts at or beyond the edge of the continental shelf (tract groups P1, P2, P4, P5, and P9 of the oil spill risk

analysis model). These deletions would reduce the risk of oil spill by a similar percentage, and would greatly reduce risk of spill landfall on North Carolina coasts. Risk from the nearshore tracts (group P3) would remain, however. Potential for onshore impact due to onshore facilities, etc., would also be greatly reduced. As noted above, however, routine offshore operations are not expected to degrade water quality except in the vicinity of the drilling operations and onshore impact is projected to consist only of minor increases in domestic sewage loading.

Conclusion for Alternative B-2

Implementation of Alternative B-2 would eliminate 45% of the proposed tracts from this sale, and would reduce the potential for water quality degradation because of the reduced level of activities, both onshore and offshore, that would result from the sale. Potential for oil spills would be reduced by the same percentage, but potential for oil spill landfall along coastal North Carolina would be especially reduced.

(c) Alternative B-3 (Deletion of Nearshore Tracts)

Implementation of Alternative B-3 would eliminate 2% of the proposed tracts from sale, namely those six tracts southeast of Cape Lookout (tract group P3 of the oil spill model). This alternative would result in no significant overall reduction in water quality degradation, as compared to Alternative A. There would be a significant reduction in risk of an oil spill reaching North Carolina shores within 3 days of spill occurrence, however. As noted above, routine operations associated with the proposed sale are not anticipated to produce a significant adverse water quality impact, either offshore or onshore, regardless of whether or not this alternative is implemented.

Conclusion for Alternative B-3

Implementation of Alternative B-3 would eliminate only 2% of the proposed tracts this sale, and so would not significantly reduce the potential for water quality degradation because of reduced level of onshore or offshore activities. However, this alternative would signficantly reduce the risk of an oil spill reaching North Carolina shores within 3 days of spill occurrence.

(d) Alternative C (Delay the Sale)

Conclusion for Alternative C

Implementation of this alternative would delay any impacts associated with the sale, but would not be expected to reduce the magnitude of impacts. As noted above, however, only oil spills pose potential serious risk of water quality degradation. These are expected to be few in number and of short duration.

(e) Alternative D (Withdraw the Sale)

Conclusion for Alternative D

Implementation of this alternative would totally eliminate any water quality degradation anticipated as a result of the proposed sale.

2. Unavoidable Adverse Environmental Effects

Holding the sale as proposed would have certain unavoidable adverse environmental effects, as does any industrial development. These effects are summarized in Section II. The conclusion is that: (1) the normal and routine activities of oil and gas exploration and development operations will produce no significant long-term adverse environmental effects, although in a few instances (pipeline construction, muds and cuttings disposal,

etc.) short-term local adverse effects may result; and (2) non-routine incidents, such as blowouts and oil spills, may produce significant and longer-term adverse effects, depending on the location and size of the incident, but the likelihood of such an incident occurring in or near an area where the effects woult be significant (in shallow water, nearshore, in wetlands, etc.) is statistically very small.

The unavoidable adverse environmental effects on specific resources, as summarized in Section II and discussed in detail in Sections IV.D. 1. and 2., are briefly stated below:

Air Quality: Routine operations will result in a slight decrease in air quality in localized areas. Blowouts and oil spills, and especially any accompanying fires, could result in severe degradation of air quality for the duration of the incident in a localized area.

West Indian Manatee: West Indian manatees may be affected by offshore service vessel traffic (not to exceed 1-3 trips/week) in the Savannah/Brunswick/Jacksonville harbors. The degree/occurrence of vessel-manatee collisions have not been determined; the biological opinion of the FWS is that no jeopardy will occur from leasing and exploration activities.

Commercial Fisheries: The most important adverse effect on commercial fisheries from routine operations will be loss of fishing areas due to drilling rigs, platforms, and perhaps oil and gas related boat traffic, but even this will be small in relation to the total area fished. Large oil spills could have significant long-term impacts if they drift into shallow areas or wetlands, but the likelihood of this occurring is minimal.

Community Services and Facilities: The most significant adverse impact that might arise in this area is the financing of services and facilities.

Recreational Fishing: Little adverse impact is expected to recreational fishing from routine operations, and even an oil spill, while perhaps creating significant short-term and localized impacts, will have no long-term impacts.

Shoreline Recreation: Little adverse impact is expected from routine operations, but an oil spill reaching a recreational area could significantly impact the area until cleanup operations and natural processes removed the oil.

Tourism: An oil spill will likely adversely affect businesses which depend on shoreline recreators for a short time.

Water Quality: Routine operations will degrade offshore water quality a small extent, and in a small area. Onshore degradation will be more severe and over an extended period of time in the vicinity of terminal and storage facilities and gas proocessing facilities. Oil spills will have a severe local effect on water quality until the oil is sunk, dispersed, or degraded by natural forces.

3. Irreversible and Irretrievable Commitment of Resources

Leasing of the tracts in this proposed sale will permit development and extraction of the oil and gas resources contained therein. Estimates by the USGS of net recoverable resources range from 0.8-2.1 billion barrels of oil and from 1.4-3.5 trillion cubic feet of gas. Production of these resources at this time precludes their use by future generations and constitutes an irreversible loss of petroleum resources.

During the period 1970 through 1978, a total of 139 fatalities and 212 injuries have occurred as a result of blowouts, fires, explosions, falls, vessel collisions or sinkings, drownings, electrocutions, etc., associated with offshore oil and gas activities on the OCS (USDI, GS, 1979a). During this same period, a total of 8,513 new wells were started (USDI, GS, 1979a). This gives us a measure of the rates of fatalities (1 per 61 new wells started) and injuries (1 per 40 new wells started) associated with drilling activities on the OCS. Assuming that the maximum number of wells for the proposed sale (1,400 wells) is attained, we can estimate that 23 fatalities and 35 injuries will occur during the 30-year life of the fields. Such deaths and injuries are an irretrievable loss of human resources. Although such incidents cannot be completely eliminated, they are minimized by continuous updating of OCS safety standards.

Additionally, we can estimate the resources committed and probable human losses as a result of OCS Sale 43. That sale included 225 tracts offered, with resource estimates of 0.28-1.01 billion barrels of oil and 1.89-6.81 trillion cubic feet of gas (USDI, BLM, 1977). Only 43 of the proposed tracts were actually leased; on a propor-

tional basis, this implies that 0.054-0.19 billion barrels of oil and 0.36-1.30 trillion cubic feet of gas will be produced, and that 49-138 wells will be drilled, resulting in 0-2 deaths and 1-3 injuries.

The final environmental impact statement for Sale 43 discusses these topics in somewhat more detail, and considers loss of fish and wildlife resources, recreational resources, land resources, and economic resources. In general, all these resources may be potentially committed or lost for the short or long term, but not irreversibly or irretrievably (USDI, BLM, 1977; pp. VII-1 to VII-2).

Conclusion

Leasing of all tracts in the proposed sale will result in production of 0.8-2.1 billion barrels of oil and 1.4-3.5 trillion cubic feet of gas, with concomitant human losses of 23 lives and 35 major injuries.

Cumulative Impact

Leasing of all tracts in the proposed sale, when considered in conjunction with existing Sale 43 leases, will result in production of 0.85-2.29 billion barrels of oil and 1.76-4.80 trillion cubic feet of gas, and will result in loss of 25 human lives and 38 major injuries due to oil and gas related accidents.

4. Relationship Between Short-term Use of Man's Environment and Maintenance and Enhancement of Long-term Productivity

As discussed previously in this section, the oil/gas operations as a result of this proposal will have a moderate, localized and short-term effect on some of the living resources of the South Atlantic OCS region. Some plants and animals may be killed, and some habitat may be eliminated. Overall, the long-term effects on the biota are considered to be minimal. If all oil/gas operations were terminated, within 1-3 years the biological communities would be expected to return to pre-drilling levels and compositions in all localized areas except where large oil spills occur. Longer durations are indicated on benthic communities or intertidal areas affected by large spills. The overall estimated oil spill probability (based on existing leasing, proposed sale leases, and transportation scenarios) is a minimum of 10% in the Brunswick area for a 3 day period, increasing to 20% for 30 days.

The induced development may result in short-term adverse impacts to communities. A strain on existing infrastructure would be expected if new sale-related facilities are located in areas of low population gains and induced industrial development are absorbed in the expanded communities. Land utilized for facilities directly associated with OCS operations will be excluded from other uses over the 30 year life of the field; however, only a portion of this land may continue to be so utilized after production ceases.

Conclusion

The impacts of field development from this sale are expected to decrease biological productivity in some minor fashion for the short-term while enhancing economic activity. Ultimate long-term environmental productivity of the living resources is not expected to be significantly reduced.

Section V

Consultation And Coordination

V

V. CONSULTATION AND COORDINATION

The OCSLA, as amended, gives the Secretary, DOI, authority to administer the provisions of the Act relating to leasing of the OCS. This authority has, in turn, been delegated to the BLM for pre-leasing and the USGS for post-leasing operations. The BLM is the lead agency in the preparation of this DEIS and has consulted with many outside cooperating sources, particularly the USGS, to obtain resource data and develop major issues and concerns.

A. Leasing Process

Throughout the federal OCS leasing process, the BLM follows a set of procedures for contacting and coordinating with federal, state and local governments, institutions, public interest groups, and concerned individuals, in order to fulfill the OCSLA requirements and regulations of the Council on Environmental Quality to involve others in the planning and decision-making process of any federal OCS action (see Section I.D.).

The following is a general discussion of the procedures implemented for each step in the leasing process for the proposed sale. Where applicable, a specific discussion is included for this proposed sale.

1. Resource Reports: These technical reports are requested by BLM from other federal agencies with expertise appropriate to the needs of information about such disciplines as geology, coastal zone management, sport and commercial fishing, and recreation use (see Section V.B.). Although resource reports are not requested from the state(s), data obtained from various state agencies are used by federal agencies in their responses to BLM. Contacts with state representatives are made as needed on an informal basis.

For this proposal, numerous informal contacts were made with many individuals representing several state agencies. Such contacts were intensified during the preparation of the resource descriptions for the environmental briefing for tract selection.

2. Call for Nominations and Comments: Copies of the Call for Nominations are prepared in the Bureau of Land Management's Washington Office and sent to the Governor of each impacted state two or three days prior to the publication of the Call notice in the Federal Register.

On March 30, 1979, the Call for Nominations was published in the Federal Register (44 FR 19046) with a closing date of May 5, 1979, which identified a broad potential lease area in the South Atlantic from North Carolina to Florida. It also requested nominations (including negative nominations) and comments from industry, governmental agencies, academia, private citizens and environmental groups regarding tracts within the sale area. Blocks with the greatest potential for oil and gas were identified as well as areas of environmental concern. In response, 7 companies nominated 944 tracts covering approximately 2.16 million hectares (5.34 million acres). From these 944 tracts, 286 tracts were selected for the proposed sale of which 222 received negative comments by either the Natural Resources Defense Council, Inc., Georgia Conservancy, or National Marine Fisheries Service. These 222 tracts represent 78% of the total sale tracts.

3. Tract Selection: Prior to the closing deadline for receipt of nominations and comments, the states are contacted by the OCS Manager with a request that a Governor's representative attend the environmental briefing and tract selection meetings. Due to the proximity of this sale area to the Commonwealth of Virginia, coordination was also conducted with that state. Each state is offered the opportunity to comment on matters of concern relating to offshore, nearshore, or onshore sensitivity. To assist the states in preparing for OCS participation, maps indicating industry interest areas are delivered to the governor.

In regard to the tract selection process for this proposed sale, state representatives were invited to attend two formal coordination meetings on June 13 and 22, 1979 in Atlanta, Georgia. At the June 13 briefing there were 11 representatives from the five states and 20 federal agency representatives; at the June 22 briefing there were 5 state representatives and 10 federal agency representatives.

Because of environmental concerns expressed and results of analysis by USGS that oil-bearing structures did not exist under some of the nominated lands, the amount of acreage originally nominated was reduced to a recommended 658,944 hectares (1,628,251 acres) for this proposed sale. A Notice of Intent to prepare an

Environmental Impact Statement was published in the Federal Register on July 20, 1979. The USGS was then requested to provide resource estimates as well as development timetables and estimates.

4. Tentative Announcement of Tracts: The Director informs the respective governor(s) of the forthcoming tract selection announcement by telegram which is then followed by a mailing of copies of the tentative tract list and the press release. The OCS Manager informs each state representative by telephone of any significant changes which have occurred to the tract lists. On August 1, 1979, the tracts for this proposed sale were announced to the public and are listed in Appendix A.

5. Section 7 of the Endangered Species Act: This section requires formal consultation between the BLM, USGS, and National Marine Fisheries Service about endangered species which may be affected by this proposal. This was done on October 30, 1979 (see Appendix B for Biological Opinions).

6. Stipulation Meetings: Oil and gas exploration and development activities have the potential for causing negative environmental impacts (see Section IV.C.); therefore, stipulations are attached as an additional mitigating measure to any lease on a tract considered to have potential for such harm. Two stipulation meetings were held for this proposed sale on October 29, 1979, and February 5, 1980. As a result of these meetings, stipulations were formulated covering archeology, biology, military areas, ordnance, and transportation (see Section I.C.2.). A geological stipulation may occur in a sale but hazardous conditions are not known until the USGS has had sufficient time to gather geological hazards information, usually 60 days prior to the final EIS. On the basis of this report, recommendations are made relative to a stipulation or deletion of tracts. The hazards reports are subsequently published as an Open File Report by the Geological Survey.

7. Oil Spill Model: These models are developed by the USGS for the purpose of predicting probabilities for oil spill occurrence in the proposed area. This information is developed as an aid in assessing the potential environmental impacts which could occur as a result of an oil spill. Appendix D comprises information developed for this sale.

8. Public Scoping Meetings: Several public scoping meetings were held at cities which the respective state coordinators had determined would most likely be the areas to attract the greatest public participation in the affected coastal states and at which issues and concerns could be developed. The meetings were held at the following locations:

Florida	: August 16, 1979 - Daytona Beach
Georgia	: August 15, 1979 - Brunswick
North Carolina	: August 21, 1979 - Manteo
	: August 22, 1979 - Atlantic Beach
	: August 23, 1979 - Wilmington
South Carolina	: August 14, 1979 - Charleston

Legal notices and news releases were placed in area newspapers which outlined general information about proposed Sale 56 and the forthcoming meetings. Areawide radio and television stations in the scoping cities and surrounding areas were mailed copies of the news releases and requested to publicize them.

A general mailing was sent to all recipients of past OCS environmental impact statements and to institutions and individuals who the BLM believed might have an interest in the proposed sale. The states also publicized these meetings and were in attendance there at the meetings.

As a result of these meetings, comments and concerns were voiced about several general areas of concern which are listed below.

1.	Aesthetics	8.	Legal and administrative issues
2.	Biologically sensitive areas	9.	Noise
3.	Energy conservation and alternative sources	10.	Oil spills
4.	Endangered species	11.	Oil spill risk analysis
5.	Environmental studies	12.	Tourism
6.	Fisheries resources	13.	Transportation
7.	Land use and related issues	14.	Social and economic issues
		15.	Weather

These 15 topics, and the majority of the comments and concerns received during scoping, are discussed within the context of this DEIS (see Section VIII, Index).

The comments and concerns received during scoping are further analyzed in the summary impact assessment section of Appendix F.6. to separate the more significant issues and alternatives (major impact areas) from the non-significant issues and alternatives (minor impact areas). This scoping process was used to select the nine issues and six alternatives below as the most significant for further analysis and remove the minor isssues from further analysis in this DEIS.

Selected Issues	Selected Alternatives
Air Quality	Alternative A - Hold the Sale as Proposed
West Indian Manatee	Alternative B-1 - Delete 42 Fisheries Tracts
Commercial Fisheries	Alternative B-2 - Delete 130 Deepwater Tracts
Live Bottoms and Reefs	Alternative B-3 - Delete 6 Nearshore Tracts
Community Services and Facilities	Alternative C - Delay the Sale
Recreational Fishing	Alternative D - Withdraw the Sale
Shoreline Recreation	
Tourism	
Water Quality	

The alternatives (B-1, B-2, B-3, C, and D) were developed in response to the comments and concerns expressed during the scoping process (see Appendix F.2.); the titles are self-explanatory. A detailed discussion of each alternative and its respective environmental consequences are in Section IV.D.

9. Aerial Inspection: Subsequent to these scoping meetings, representatives from each of the affected states were invited by the BLM to join its staff in an aerial inspection of the South Atlantic coastal areas about which the DEIS was being developed. This inspection was flown November 6-7, 1979 and was made primarily to better acquaint the staff with a personal, visual perspective and to hear commentary by state authorities relative to site specific areas of consideration.

10. Studies Meetings: Immediately following the flight, a 2-day studies meeting was held in Atlanta, Georgia, at which discussions were held between studies contractors, state representatives and BLM personnel about the status of relevant and ongoing or planned studies. Workshops were held covering topics on biology, chemistry, geology, oceanography, planning, and recreation. For a discussion of the meetings, see Appendix F.

11. Draft Environmental Impact Statement (DEIS): The Department has committed itself to prepare site-specific draft environmental impact statements on each proposed OCS lease sale, in addition to the programmatic EIS which was published and made available to the public in March of 1980 (USDI, 1980). A preliminary DEIS is distributed by the OCS Manager to state representatives for their review and comment. Comments received on the PDEIS are considered in the preparation of the DEIS.

Once the tract selection is completed and the area for a proposed lease sale defined, the Bureau proceeds with the preparation of this draft EIS in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA). This draft EIS is submitted to the Council on Environmental Quality (CEQ) and made available for public review and comment.

On the day DEIS availability is announced in the Federal Register, the OCS Manager delivers copies of the DEIS to the Office of the Governor of each concerned state. At the same time, official distribution is made to each State Clearinghouse.

12. Public Hearing: Opportunity for State participation in the OCS public hearings is routinely provided by BLM. Specific dates and locations are announced in the Federal Register after the DEIS is published. After a review and comment period of at least 45 days, public hearings are conducted. These hearings will be followed by an additional 15 days during which time the public may submit comments on the DEIS.

13. Final Environmental Impact Statement (FEIS): All comments received in conjunction with the DEIS and the Public Hearing will be considered in preparing the FEIS, scheduled for release in January, 1981. Formal distribution of the FEIS is made to the CEQ, the states, the depository libraries, and the general public.

14. Secretarial Issue Document (SID): Concurrently with the preparation of the FEIS, a SID presenting the significant issues and identifying the alternative actions, is developed for use by the Secretary of the Interior. The SID brings to the decisionmaker's attention all factors associated with the proposed action. These include environmental and physical factors, and other issues, including potential economic and social impacts of the proposal and its affect on the Department's program. The SID and the FEIS provide the necessary information to the Secretary of the Interior to make a decision on various sale options, including whether or not to hold a sale.

15. Notice of Sale: If a decision to hold the sale is made by the Secretary, the Manager will contact the governor of each affected state and provide him with a copy of the Proposed Sale Notice for further review and comment. The DOE is also supplied with a copy for their review and comment.

16. Proposed and Final Notices of Sale: If a decision is made to proceed with the sale, BLM prepares a notice for publication in the Federal Register, which includes information on sale procedures and the method(s) of bidding which is designed by the Department's Office of Policy Analysis and the DOE. A copy is sent to the governors of the affected states for a 60 day review and submission of any comments or recommendations. After this 60 day period a final decision is made regarding method of bidding, lease stipulations and all terms and conditions of the sale. A final notice is prepared and reviewed principally by Fish and Wildlife Service, U.S. Geological Survey, and Department of Energy.

17. Lease Sale: At the lease sale, sealed industry bids for individual tracts are opened, read and recorded. After an assessment is made by the BLM, USGS, and the Department of Justice, leases may be awarded to the highest, qualified bidders, with stipulations. The Secretary reserves the right to withdraw tracts from consideration for the sale, as well as reject bids received. This proposed sale is tentatively scheduled for August, 1981.

There are approximately 21 months between the Call for Nominations and the actual lease sale.

The actual lease sale signals the beginning of the exploratory phase. Exploration operations may be expected to begin six months to a year from the lease sale. The end of the exploration phase simply defines the "go/no-go" point, at which development activities may be initiated. If extensive exploration indicates that no marketable reserves exist in the area, the lease may be relinquished.

18. Environmental Monitoring: Environmental monitoring studies, including both physical and biological studies, will be conducted in the vicinity of certain tracts as a part of the ongoing BLM OCS Environmental studies Program, and perhaps as a result of stipulations on certain tracts. Monitoring of biological and some chemical aspects of the environment will be conducted at so-called "live bottom" habitats off Georgia, South Carolina, and North Carolina as a part of the South Atlantic OCS Living Marine Resources Study. Geological and geophysical studies are conducted yearly via the South Atlantic OCS Geological Studies program, and physical, oceanographic, and meteorological studies are performed through the South Atlantic OCS Physical Oceanography and Data Buoy programs. Unique conditions on the Blake Plateau, including geohazards and biological communities are being studied via the South Atlantic/Blake Plateau Hazards Mapping Study. Additionally, some studies

may be performed in the vicinity of selected sensitive biological resources as a result of the biological stipulations on certain tracts. Requirements may vary, but oil companies may be required to perform studies if operations occur in proximity to known or suspected biologically sensitive areas (see Section I.C.2.b.).

Other federal agencies, states, and representatives of industry and the private sector may provide input to studies needs or designs through Secretarial Order 2974, the Intergovernmental Planning Program, and the environmental issues identification ("scoping") process.

B. Coordinating Agencies

The following is a listing of contacts made during the scoping process discussed above:

Federal Government
- Commissions and Councils
  - Advisory Council on Historic Preservation
  - Federal Communications Commission
  - Federal Trade Commission
  - Interstate Commerce Commission
  - Marine Mammal Commission
  - Nuclear Regulatory Commission
  - Water Resource Council
- Departments of the United States
  - Air Force : Manpower, Reserve Affairs and Installations
  - Army : Civil Works
  - Commerce : Environmental Affairs
    - National Aeronautics and Space Administration
    - National Marine Fisheries Service
    - Office of Coastal Zone Management
  - Defense : Manpower, Reserve Affairs and Logistics
  - Energy : Environment
  - HUD : Community Planning and Development
    - Office of Environmental Affairs
  - HEW : Management, Planning and Technology
    - Office of Environmental Affairs
    - Public Health Service
      - Division of Preventive Health Services
  - Interior : Bureau of Mines
    - Fish and Wildlife Service
    - Geological Survey
    - Heritage Conservation and Recreational Service
    - National Park Service
  - Justice : Assistant Attorney General
    - Land and Natural Resources Division
  - Labor : Policy, Evaluation and Research
  - Navy : Manpower, Reserve Affairs and Logistics
  - State : Environmental and Population Affairs
  - Treasury : Administration
  - Transportation : Coast Guard
    - Marine Environment and Systems
    - Environment, Safety and Consumer Affairs

Other

- Environmental Protection Agency
- National Science Foundation
- National Transportation Safety Board
- Smithsonian Institution

States

- Florida
  - Area Planning Board of Palm Beach County
  - Broward County Area Planning Board
  - Daytona Beach Area Chamber of Commerce
  - Florida Department of Administration
    - Division of State Planning
  - Florida Department of State
    - Division of Archives, History and Records Management
  - Florida Institute for Oceanography
  - Jacksonville Area Planning Board
  - Metropolitan Dade County Planning Department
  - Northwest Florida Development Council
  - Palm Beach County Area Planning Board
  - Regional Planning Councils
    - Apalachee
    - Central Florida
    - East Central Florida
    - North East Florida
    - North Central Florida
    - South Florida
    - South West Florida
    - Tampa Bay
    - Treasure Coast
    - West Florida
  - Tallahassee-Leon County Planning Commission
- Georgia
  - Brunswick-Glynn County Joint Planning Commission
  - Chatham County-Savannah Metropolitan Planning Commission
  - Coastal Area Planning and Development Commission
  - Georgia Office of the Governor
    - Department of Natural Resources
      - Coastal Resources Program
      - Historic Preservation Section
    - Planning and Budget
  - South East Georgia Area Planning and Development Commission
  - The Georgia Conservancy
- North Carolina
  - Albemarle Regional Planning and Development Commission
  - Cape Fear Council of Government
  - Carteret County Planning Commission
  - Coastal Resource Commission
  - Low County Regional Planning Council
  - Mid-East Commission
  - Neuse River Council of Governments

- North Carolina Office of the Governor
    - Department of Administration
    - Department of Commerce
        - Energy Division
        - Division of Industrial Development
    - Department of Cultural Resources
    - Department of Natural Resources and Community Development
    - Division of Policy Development
    - Wilmington-New Haven Planning Department

South Carolina

- Berkeley-Charleston-Dorchester Council of Governments
- Pee Dee Regional Planning and Development Council
- South Atlantic Regional Fisheries Management Council
- South Carolina Coastal Council
- South Carolina Office of the Governor
    - Department of Archives and History
    - Office of the State Auditor
- Waccamaw Regional Planning and Development Council

Virginia

- Virginia Institute of Marine Science
- Virginia Office of the Governor

Section VI

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VI

VI. PREPARERS

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Jack H. Rebman, Oceanographer
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Melissa W. Smith, Oceanographer
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Section VII

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VII. REFERENCES

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Section VIII

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Section IX

Appendices

IX

APPENDIX A

PROPOSED TRACT LIST

PROPOSED TRACT LIST
OCS SALE NO. 56

Tract	Block	Description	Reserve	Hectares	Distance From Shore (nmi)	Water Depth (m)
CURRITUCK SOUND NJ 18-11						
1	777	All	O/G	2304	57	1000
2	821	All	O/G	2304	56	1350
3	865	All	O/G	2304	55	1350
4	909	All	O/G	2304	53	1300
5	953	All	O/G	2304	52	1350
MANTEO NI 18-2						
6	246	All	O/G	2304	37	200
7	247	All	O/G	2304	40	800
8	290	All	O/G	2304	37	200
9	291	All	O/G	2304	40	800
10	334	All	O/G	2304	36	300
11	335	All	O/G	2304	39	800
12	378	All	O/G	2304	36	400
13	379	All	O/G	2304	39	800
14	422	All	O/G	2304	36	400
15	423	All	O/G	2304	39	1000
16	466	All	O/G	2304	37	500
17	467	All	O/G	2304	39	1100
18	510	All	O/G	2304	37	900
19	511	All	O/G	2304	40	1200
20	553	All	O/G	2304	34	600
21	554	All	O/G	2304	37	1200
22	555	All	O/G	2304	40	1700
23	597	All	O/G	2304	34	1000
24	598	All	O/G	2304	37	1700
25	640	All	O/G	2304	32	1000
26	641	All	O/G	2304	35	1800
27	642	All	O/G	2304	38	2100
RUSSELL NI 18-5						
28	709	All	O/G	2304	48	900
29	710	All	O/G	2304	51	1500
30	751	All	O/G	2304	45	500
31	752	All	O/G	2304	47	800
32	753	All	O/G	2304	50	1000
33	754	All	O/G	2304	52	1800
34	794	All	O/G	2304	45	400
35	795	All	O/G	2304	47	550
36	796	All	O/G	2304	49	850
37	837	All	O/G	2304	45	400
38	838	All	O/G	2304	47	500
39	839	All	O/G	2304	49	800

Tract	Block	Description	Reserve	Hectares	Distance From Shore (nmi)	Water Depth (m)
BEAUFORT NI 18-4						
40	566	All	O/G	2304	16	20
41	567	All	O/G	2304	18	20
42	610	All	O/G	2304	18	20
43	611	All	O/G	2304	20	22
44	654	All	O/G	2304	21	24
45	655	All	O/G	2304	23	26
CAPE FEAR NI 18-7						
46	175	All	O/G	2304	59	550
47	176	All	O/G	2304	61	610
48	219	All	O/G	2304	62	610
49	220	All	O/G	2304	63	660
50	262	All	O/G	2304	64	590
51	263	All	O/G	2304	65	650
52	264	All	O/G	2304	66	730
53	306	All	O/G	2304	67	640
54	307	All	O/G	2304	68	710
55	308	All	O/G	2304	69	800
56	350	All	O/G	2304	70	670
57	351	All	O/G	2304	71	760
58	352	All	O/G	2304	72	900
59	393	All	O/G	2304	71	640
60	394	All	O/G	2304	72	720
61	395	All	O/G	2304	73	820
62	396	All	O/G	2304	74	1060
63	437	All	O/G	2304	74	670
64	438	All	O/G	2304	75	760
65	439	All	O/G	2304	76	920
66	440	All	O/G	2304	77	1250
67	481	All	O/G	2304	77	700
68	482	All	O/G	2304	78	800
69	483	All	O/G	2304	79	1000
70	484	All	O/G	2304	80	1350
71	524	All	O/G	2304	79	680
72	525	All	O/G	2304	80	730
73	526	All	O/G	2304	81	850
74	527	All	O/G	2304	82	1100
75	528	All	O/G	2304	83	1400
76	568	All	O/G	2304	82	700
77	569	All	O/G	2304	83	750
78	570	All	O/G	2304	84	900
79	571	All	O/G	2304	85	1150
80	611	All	O/G	2304	85	700
81	612	All	O/G	2304	85	740
82	613	All	O/G	2304	86	800
83	614	All	O/G	2304	87	950
84	615	All	O/G	2304	88	1250

Tract	Block	Description	Reserve	Hectares	Distance From Shore (nmi)	Water Depth (m)
CAPE FEAR NI 18-7 (continued)						
85	654	All	O/G	2304	87	690
86	655	All	O/G	2304	88	730
87	656	All	O/G	2304	88	800
88	657	All	O/G	2304	89	900
89	658	All	O/G	2304	89	1100
90	698	All	O/G	2304	90	710
91	699	All	O/G	2304	91	780
92	700	All	O/G	2304	91	880
93	701	All	O/G	2304	92	1000
94	702	All	O/G	2304	92	1250
95	741	All	O/G	2304	93	690
96	742	All	O/G	2304	93	730
97	743	All	O/G	2304	94	790
98	744	All	O/G	2304	94	890
99	745	All	O/G	2304	94	1100
100	746	All	O/G	2304	95	1400
101	747	All	O/G	2304	96	1690
102	785	All	O/G	2304	96	710
103	786	All	O/G	2304	96	750
104	787	All	O/G	2304	96	810
105	788	All	O/G	2304	97	930
106	789	All	O/G	2304	97	1200
107	790	All	O/G	2304	98	1550
108	791	All	O/G	2304	99	1850
109	828	All	O/G	2304	99	700
110	829	All	O/G	2304	99	730
111	830	All	O/G	2304	99	790
112	831	All	O/G	2304	100	870
113	832	All	O/G	2304	100	1000
114	834	All	O/G	2304	101	1650
115	872	All	O/G	2304	102	720
116	873	All	O/G	2304	102	770
117	874	All	O/G	2304	102	850
118	875	All	O/G	2304	102	950
119	876	All	O/G	2304	103	1130
120	916	All	O/G	2304	104	760
121	917	All	O/G	2304	105	820
122	918	All	O/G	2304	105	900
123	919	All	O/G	2304	105	1040
124	960	All	O/G	2304	107	790
125	961	All	O/G	2304	108	840
126	962	All	O/G	2304	108	930
127	963	All	O/G	2304	108	1060
128	1004	All	O/G	2304	110	820
129	1005	All	O/G	2304	111	870
130	1006	All	O/G	2304	111	940

Tract	Block	Description	Reserve	Hectares	Distance From Shore (nmi)	Water Depth (m)
JAMES ISLAND NI 17-12						
131	242	All	O/G	2304	34	32
132	243	All	O/G	2304	37	34
133	244	All	O/G	2304	39	34
134	245	All	O/G	2304	42	34
135	246	All	O/G	2304	44	34
136	247	All	O/G	2304	47	34
137	285	All	O/G	2304	34	32
138	286	All	O/G	2304	36	32
139	287	All	O/G	2304	38	34
140	288	All	O/G	2304	41	38
141	289	All	O/G	2304	43	40
142	290	All	O/G	2304	46	38
143	291	All	O/G	2304	48	39
144	329	All	O/G	2304	36	32
145	330	All	O/G	2304	38	35
146	331	All	O/G	2304	40	38
147	334	All	O/G	2304	47	40
148	335	All	O/G	2304	50	41
149	373	All	O/G	2304	38	39
150	374	All	O/G	2304	40	39
151	800	All	O/G	2304	39	35
152	841	All	O/G	2304	37	29
153	842	All	O/G	2304	38	32
154	843	All	O/G	2304	39	34
155	844	All	O/G	2304	41	36
156	885	All	O/G	2304	39	31
157	886	All	O/G	2304	40	33
158	887	All	O/G	2304	41	34
159	888	All	O/G	2304	43	40
160	929	All	O/G	2304	42	30
161	930	All	O/G	2304	43	35
STETSON MESA NH 17-6						
162	181	All	O/G	2304	100	520
163	182	All	O/G	2304	103	570
164	224	All	O/G	2304	97	490
165	225	All	O/G	2304	100	550
166	226	All	O/G	2304	103	590
167	268	All	O/G	2304	97	510
168	269	All	O/G	2304	100	580
169	312	All	O/G	2304	97	540
170	313	All	O/G	2304	100	590
171	355	All	O/G	2304	93	500
172	356	All	O/G	2304	96	560
173	357	All	O/G	2304	99	590
174	399	All	O/G	2304	93	510

Tract	Block	Description	Reserve	Hectares	Distance From Shore (nmi)	Water Depth (m)
BRUNSWICK NH 17-2						
175	256	All	O/G	2304	38	30
176	257	All	O/G	2304	41	33
177	298	All	O/G	2304	35	26
178	299	All	O/G	2304	37	28
179	300	All	O/G	2304	40	30
180	301	All	O/G	2304	42	32
181	341	All	O/G	2304	34	26
182	342	All	O/G	2304	36	28
183	343	All	O/G	2304	39	30
184	344	All	O/G	2304	41	32
185	345	All	O/G	2304	44	34
186	386	All	O/G	2304	38	30
187	387	All	O/G	2304	40	32
188	388	All	O/G	2304	43	34
189	695	All	O/G	2304	52	38
190	696	All	O/G	2304	55	40
191	697	All	O/G	2304	58	41
192	738	All	O/G	2304	50	36
193	739	All	O/G	2304	53	38
194	740	All	O/G	2304	56	40
195	741	All	O/G	2304	59	40
196	781	All	O/G	2304	49	37
197	782	All	O/G	2304	52	38
198	783	All	O/G	2304	54	39
199	825	All	O/G	2304	50	37
200	826	All	O/G	2304	53	38
201	827	All	O/G	2304	56	39
202	910	All	O/G	2304	43	34
203	911	All	O/G	2304	46	35
204	914	All	O/G	2304	54	38
205	916	All	O/G	2304	60	40
206	917	All	O/G	2304	63	40
207	952	All	O/G	2304	38	32
208	953	All	O/G	2304	41	33
209	954	All	O/G	2304	44	34
210	955	All	O/G	2304	47	35
211	960	All	O/G	2304	61	40
212	961	All	O/G	2304	64	41
213	962	All	O/G	2304	67	43
214	993	All	O/G	2304	31	21
215	994	All	O/G	2304	34	22
216	995	All	O/G	2304	37	24
217	996	All	O/G	2304	39	26
218	997	All	O/G	2304	42	28
219	998	All	O/G	2304	45	30
220	999	All	O/G	2304	48	32
221	1000	All	O/G	2304	50	34
222	1002	All	O/G	2304	56	38
223	1006	All	O/G	2304	67	42

Tract	Block	Description	Reserve	Hectares	Distance From Shore (nmi)	Water Depth (m)
JACKSONVILLE NH 17-5						
224	24	All	O/G	2304	30	24
225	27	All	O/G	2304	38	26
226	28	All	O/G	2304	40	28
227	29	All	O/G	2304	43	29
228	30	All	O/G	2304	46	30
229	31	All	O/G	2304	49	32
230	32	All	O/G	2304	51	32
231	33	All	O/G	2304	54	34
232	37	All	O/G	2304	65	39
233	69	All	O/G	2304	34	24
234	70	All	O/G	2304	37	26
235	71	All	O/G	2304	40	30
236	72	All	O/G	2304	43	28
237	73	All	O/G	2304	46	34
238	74	All	O/G	2304	49	34
239	79	All	O/G	2304	63	36
240	80	All	O/G	2304	66	38
241	113	All	O/G	2304	34	23
242	114	All	O/G	2304	37	26
243	115	All	O/G	2304	40	29
244	116	All	O/G	2304	43	31
245	117	All	O/G	2304	46	33
246	124	All	O/G	2304	66	38
247	158	All	O/G	2304	38	25
248	159	All	O/G	2304	40	28
249	160	All	O/G	2304	43	30
250	161	All	O/G	2304	46	32
251	162	All	O/G	2304	49	34
252	203	All	O/G	2304	41	28
253	204	All	O/G	2304	44	30
254	205	All	O/G	2304	47	34
255	206	All	O/G	2304	50	34
256	207	All	O/G	2304	52	35
257	247	All	O/G	2304	42	29
258	248	All	O/G	2304	45	30
259	249	All	O/G	2304	47	32
260	250	All	O/G	2304	50	34
261	251	All	O/G	2304	53	36
262	253	All	O/G	2304	59	38
263	292	All	O/G	2304	44	29
264	293	All	O/G	2304	47	32
265	294	All	O/G	2304	50	34
266	295	All	O/G	2304	53	35
267	296	All	O/G	2304	56	36
268	340	All	O/G	2304	56	35
269	382	All	O/G	2304	50	33
270	426	All	O/G	2304	49	32
271	431	All	O/G	2304	64	39

Tract	Block	Description	Reserve	Hectares	Distance From Shore (nmi)	Water Depth (m)
JACKSONVILLE NH 17-5 (continued)						
272	432	All	O/G	2304	67	41
273	465	All	O/G	2304	34	29
274	470	All	O/G	2304	49	32
275	475	All	O/G	2304	64	40
276	476	All	O/G	2304	67	42
277	509	All	O/G	2304	34	26
278	513	All	O/G	2304	46	34
279	514	All	O/G	2304	48	34
280	515	All	O/G	2304	51	33
281	516	All	O/G	2304	54	35
282	561	All	O/G	2304	57	36
283	601	All	O/G	2304	45	31
284	602	All	O/G	2304	48	33
285	645	All	O/G	2304	45	34
286	646	All	O/G	2304	48	35

APPENDIX B

BIOLOGICAL OPINIONS

APPENDIX B

United States Department of the Interior

ADDRESS ONLY THE DIRECTOR,
FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

MAR 1 1 1980

In Reply Refer To:
BLM/GS-79-4

MEMORANDUM

To: Director, Bureau of Land Management
Director, U.S. Geological Survey

From: Director

Subject: Biological Opinion Regarding Oil and Gas Leasing and Exploration Activities in the South Atlantic Region

By memorandum received September 20, 1979, the Bureau of Land Management (BLM) requested formal consultation on a regional basis for the South Atlantic oil and gas leasing activities (copy attached). This request also asked that the U.S. Geological Survey (GS) be included in the consultation. A list of 26 species was attached to the request. On October 15, 1979, GS requested a formal consultation (copy attached) for exploration activities associated with Outer Continental Shelf (OCS) Lease Sale No. 56, a South Atlantic lease sale. GS further requested that this consultation include BLM. A list of 12 species accompanied the GS request. Through further contact with GS and BLM, it was agreed that a joint consultation would take place to consider the effects of oil and gas leasing and exploration activities in the South Atlantic region upon listed species and their Critical Habitats. In response to these requests, I appointed a consultation team by memorandum of October 29, 1979, (copy attached) to assist me in determining whether leasing and exploration activities in the South Atlantic are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their Critical Habitats.

On October 30, 31, and November 1, 1979, the consultation team met with representatives of BLM and GS to discuss the proposed leasing and exploration activities in the South Atlantic (a list of participants is attached). At this time, it was agreed that the following species would

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be the subject of this consultation: Florida manatee (Trichechus manatus), American alligator (Alligator mississippiensis), American crocodile (Crocodylus acutus), Atlantic salt marsh snake (Nerodia fasciata taeniata), Kemp's Ridley sea turtle (Lepidochelys kempii), hawksbill sea turtle (Eretmochelys imbricata), leatherback sea turtle (Dermochelys coriacea), loggerhead sea turtle (Caretta caretta), green sea turtle (Chelonia mydas), brown pelican (Pelecanus occidentalis), bald eagle (Haliaeetus leucocephalus), Arctic peregrine falcon (Falco peregrinus tundrius), American peregrine falcon (F. p. anatum), Key deer (Odocoileus virginianus clavium), Florida panther (Felis concolor coryi), Eskimo curlew (Numenius borealis), Everglade kite (Rostrhamus sociabilis plumbeus), Cape Sable sparrow (Ammospiza maritima mirabilis), dusky seaside sparrow (A. m. nigrescens), Bachman's warbler (Vermivora bachmanii), Kirtland's warbler (Dendroica kirtlandii), ivory-billed woodpecker (Campephilus principalis), red-cockaded woodpecker (Picoides (=Dendrocopos) borealis), eastern indigo snake (Drymarchon corais couperi), Schaus swallowtail butterfly (Papilio aristodemus ponceanus), Bahaman swallowtail butterfly (P. andraemon bonhotei) and Stock Island tree snail (Orthalicus reses).

The consultation team reviewed data on each of the species involved, as well as information contained in the Final Environmental Impact Statement (EIS) for OCS Sale 43, the Draft EIS on the Proposed Five Year OCS Oil and Gas Lease Schedule, and other information available on the activities and species. In addition, some members of the team visited offshore platforms and participated in a BLM sponsored overflight of the South Atlantic coastal area to gain first-hand knowledge of the area and activities associated with OCS exploration. Copies of pertinent records and documents are included in an administrative record maintained in Washington, D.C. at the Office of Endangered Species and are incorporated in this opinion by reference.

Project Description

The BLM acts as the Secretary of Interior's agent in arranging for and processing bids on offshore oil and gas lease sales. After the issuance of the leases, the GS assumes the authority to administer the lease areas. Among other things, this includes the approval of exploratory and development/production plans submitted by the lessee.

Based upon current information and plans, it was decided to limit this consultation to the leasing and exploration of those South Atlantic OCS Sales which appear in the Proposed OCS Oil and Gas Lease Sale Schedule dated June, 1979, (Sales 56 and 78) and that the area considered for potential leasing is bounded by the Virginia-North Carolina border and 28 degrees North Latitude (N Lat.), which is about 20 miles south of Merritt Island National Wildlife Refuge (NWR).

The Sale 56 area includes 286 blocks (just over 1.6 million acres) to be offered for lease in August of 1981. These tracts are clustered in the Sale 43 area (the only previous South Atlantic sale), and off Wilmington, Cape Lookout, and the Outer Banks of North Carolina. Most of these blocks are over 30 miles from shore, although the six blocks off Cape Lookout are as close to shore as 15 miles. A draft EIS on this proposed sale is scheduled for release in July 1980, with a final EIS due in January 1981. The Sale 78 area has not yet been firmly identified, although it is tentatively scheduled to include the Blake Plateau, a deep water area located east of the Sale 43 tracts. It is estimated that approximately 800,000 acres will be offered for lease in this sale. This sale is scheduled to be held in January 1984, with draft and final EIS's due to be released in November 1982 and June 1983 respectively.

Exploration of the OCS requires certain onshore support facilities including office space, helicopter and fixed-wing aircraft facilities, docks for boating activities and supply bases. Due to the uncertain nature of oil and gas exploration, companies are generally unwilling to construct new facilities or develop new onshore areas to support this operation. Instead, they prefer to utilize existing onshore facilities.

At present, there are a number of existing facilities which can be used during offshore exploration. The port facilities being considered are: Norfolk, Virginia; Morehead City and Wilmington, North Carolina; Charleston and Beaufort, South Carolina; Savannah and Brunswick, Georgia; and Jacksonville and Port Canaveral, Florida. These port facilities lie in close proximity to airports and urban/industrial areas. Currently, the exploratory activities resulting from OCS Sale 43 are based in Brunswick, Georgia. Therefore, it is believed that areas which are undeveloped will not be altered to support offshore exploration activities. Should other ports be used or additional facilities be required which may affect listed species or their habitats, consultation must be reinitiated.

There is a possibility of oil spills occurring during the exploratory phase of OCS activity. Spills may be from two sources: (1) small spills which occur during the handling of fuel oil, and (2) blowouts of exploratory wells. The first source is minor and is not expected to result in any noticeable increase in oil pollution. Therefore, this impact is considered negligible. A blowout, however, can cause the release of significant amounts of hydrocarbons into the marine environment and may affect listed species.

The Campeche, Mexico oil spill is a dramatic example of an exploration blowout. While the exact causes of this blowout are likely to remain unknown because of the sensitive diplomatic conditions existing between Mexico and the United States, it appears that operating procedures,

rather than technology, were at the root of the accident. According to statistics compiled by GS, the probability of a blowout occurring during exploration in the offshore waters of the United States is remote. OCS operating orders require that a number of safety devices and procedures be employed to prevent such an accident. These include the use of blowout preventers, strict drilling procedures, regular testing of safety equipment, training of personnel, regular inspections by GS personnel, and approval by GS of all drilling plans and modifications.

When a blowout occurs, the spilled oil is driven by the direction and velocity of oceanic currents and winds. These patterns in the South Atlantic region indicate a high probability that spills, if they occur, would wash ashore. There is also a very small chance, that spilled oil could be carried south along the coast of Florida and impact the Keys. However, based on the above discussion, the probability of a large spill occurring during exploration is quite remote.

Should exploration activities reveal the presence of significant amounts of hydrocarbons, development and production activities will occur. These activities will include new onshore facilities, the construction and placement of offshore platforms designed for a lifetime in excess of 20 years, and the development of transportation systems to deliver hydrocarbons to refineries and gas processing plants. Development/production activities also result in accidental oil spillage. All of these activities may affect listed species, therefore, reinitiation of Section 7 consultation will be required. This biological opinion considers only the leasing and exploration activities which may occur in the South Atlantic area and assumes that the previously named bases of operation will be used. Development and production phases are not included in this opinion and, therefore, will require reinitiation of consultation, as will the approval of any exploratory plans which include the use of onshore bases other than those previously named.

Biological Accounts

A summary of the biological data and considerations of the consultation team follows:

Florida Manatee (Trichechus manatus)

The Florida manatee was originally listed in the Federal Register as Endangered on March 11, 1967. Historically, the range of the manatee in the United States was from New Jersey to southern Texas, with an estimated population of several thousand individuals. The present range of the species is from North Carolina to Louisiana. Currently, the estimated population of 750 to 900 animals is concentrated in Florida.

The manatee is apparently migratory. During the winter months, when the water temperature to the north drops below 21 degrees C, manatees concentrate on both coasts of Florida from the Crystal River (west coast) around the Florida peninsula to Titusville (east coast), and from Jacksonville south in the St. John's River. During the summer months, the population disperses along the coast.

Florida manatee Critical Habitat was designated in the Federal Register on September 24, 1976. The Critical Habitat includes portions of the Florida east coast in Volusia, Brevard, Nassau, and Duval Counties; the inland sections of water known as the Banana and Indian Rivers; and the St. John's River.

The manatee is an aquatic herbivore which feeds on submergent, emergent, and floating plants, apparently in that order of preference. Initial population decreases resulted from commercial overharvesting for meat, oil, and leather, but the current Endangered status of the manatee is attributed to mortality from accidental collisions with boats and barges. Also, malicious killings occur to an unknown degree. Actual physical habitat loss is of secondary importance, but the impact of increased boat traffic on manatee habitat is considered serious.

Despite existing heavy boat traffic, Florida manatees occur in four ports under consideration as support bases for OCS exploration activities. In Florida, Jacksonville port is within designated Critical Habitat, while Port Canaveral lies immediately adjacent to Critical Habitat. The Brunswick and Savannah, Georgia ports are within the summer range and are utilized by manatees. Boating activity associated with OCS exploration activities will incrementally increase the present level of boat traffic in these ports.

BLM plans to include an Information to Lessees notice concerning manatees in their Notice of Sale for the two sales considered during this consultation. This will put lessees on alert as to the potential conflict between their operations and manatee survival. Due to the necessarily brief nature of an Information to Lessees notice, GS will provide each lessee with an information letter further explaining the possible conflict and recommending steps a lessee may take to reduce this potential conflict. The recommendations will basically consist of those worked out by the Corps of Enginneers (COE) and the Service to avoid jeopardy to manatees from COE projects in manatee habitat.

The effects of an oil spill on manatees are essentially unknown. It is thought that manatees would suffer a loss of suitable habitat, which could be particularly significant to wintering manatees. Oil could also destroy and/or contaminate manatee food supplies. The consumption of hydrocarbon-contaminated food may cause physiological problems. While the probability of an exploratory spill is remote, the effects of oil spills on manatees must be better understood to properly evaluate the development/production phase of OCS activities.

Since all lessees will be made aware of the laws protecting manatees and ways in which their operations can avoid disturbance to manatees, it is not likely that manatees will suffer from the increased boat traffic associated with OCS exploration. This coupled with the remote possbility of an oil spill occurring during OCS exploration lead to my biological opinion that the leasing and exploration of the South Atlantic OCS is not likely to jeopardize the continued existence of the Florida manatee or adversely modify its Critical Habitat. However, should the OCS exploration activities result in development/production or any of the following actions, it is my determination that the conditions upon which this consultation is based have changed, thereby requiring reinitiation of Section 7 consultation:

(a) Increased boating activity in the immediate vicinity of warm water discharges or favorite congregating areas of the manatee.

For example, there are a number of such areas in and around the port of Jacksonville. Prior to the approval of exploration plans which call for the use of Jacksonville, Port Canaveral, Brunswick, or Savannah, you should contact Endangered Species personnel in our Jacksonville Area Office to determine known locations of warm water discharges and congregating areas and also to insure that proposed actions conform with manatee conservation efforts.

b) The use of vessels for OCS oil and gas operations in manatee habitat which are different in design from the vessels normally operating out of the ports.

Such designs may have characteristics more detrimental to manatees than those currently used in manatee habitat.

c) Discovery of hitherto unknown concentrations of manatees along routes used by exploration vessels.

American Alligator (Alligator mississippiensis)

The American alligator was originally listed as Endangered on March 11, 1967. Populations in the coastal areas of Texas, South Carolina, Georgia, Louisiana, and Florida, have begun to recover and were reclassified to Threatened status in the Federal Register on January 10, 1977. Critical Habitat has not been determined for the alligator.

The distribution of the alligator in the South Atlantic area extends from North Carolina to south Florida. It prefers fresh water, but can tolerate brackish water. Marshes and savannahs appear to provide the optimal habitat, or, at least, support more dense populations.

The alligator was listed primarily because of commercial overharvesting and loss of habitat. Fluctuation in water levels seem to be the major limiting factor on nesting success. The loss of habitat due to rapid urbanization remains as a chief threat to the alligator.

As noted elsewhere in this consultation, onshore development is expected to be limited to existing facilities in several ports; therefore, little habitat disruption should occur. Consultation must be reinitiated if onshore exploration bases are chosen which might impact alligator habitat.

Oil spills from exploration activity could impact the American alligator if the oil reached its habitat. The magnitute of impact depends upon conditions at the time of the spill (wind, currents, volume of oil, etc.). The effects of oil on alligators are unknown, but it is reasonable to expect mortality from food contamination, disruption of behavior and possible nesting failure. However, as noted elsewhere in this consultation, the possibility of a large spill resulting from exploratory operations is very remote.

Since onshore activity covered by this consultation will be in areas removed from alligator habitat, and because a major spill over a large range of alligator habitat is considered remote, it is my biological opinion that leasing and exploration activities are not likely to jeopardize the continued existence of the American alligator. However, any activity or program which is funded, authorized, or conducted by a Federal agency, particularly activities associated with development/production or exploration activities in areas other than those previously identified, will require Section 7 consultation if the American alligator may be affected.

American Crocodile (Crocodylus acutus)

The American crocodile was listed as Endangered in the Federal Register on September 25, 1975. Critical Habitat was designated in the Federal Register on September 24, 1976. The present range of the crocodile is in southern Florida where population estimates range from 200-400 individuals. The crocodile utilizes coastal areas and inhabits more saline areas than alligators. Due to its narrow geographical range, low numbers, and fragile coastal habitat, it is an extremely sensitive species.

An oil spill from an exploratory well could be carried by longshore currents into the coastal areas of southern Florida where the crocodile and its habitat could be impacted. Direct effects of oil on the crocodile are not known, but an oil spill could contaminate their food source, disrupt their behavior or cause nesting failure. In addition, any onshore facilities within the crocodile's range could disturb this reclusive species.

The total range of the American crocodile is outside the area where BLM shows an interest in oil exploration. In addition, the possibility of an exploratory spill impacting southern Florida is remote. Therefore, it is my biological opinion that leasing and exploration activities are not likely to jeopardize the continued existence of the American crocodile. However, any activity or program which is funded, authorized, or conducted by a Federal agency will require Section 7 consultation if the American crocodile may be affected.

Atlantic Salt Marsh Snake (Nerodia fasciata taeniata)

The Atlantic salt marsh snake was listed as Threatened in the November 29, 1977, Federal Register. Critical Habitat has not yet been determined.

Salt marsh snakes are the only North American snakes restricted to a brackish marsh environment and the Atlantic salt marsh snake inhabits the shallow tidal creeks and pools associated with glasswort (Salicornia spp.). Its known localities include: Daytona Beach, New Smyrna Beach, and the vicinity of National Gardens in Volusia County; Merritt Island NWR, Playalinda Beach, and the area near Micco in Brevard County; and near Vero Beach in Indian River County. The destruction of coastal marshes in these three counties has severely limited this snake's range. Further loss of habitat could threaten its survival.

Since transition zones from wetlands to uplands are key habitat for the Atlantic salt marsh snake, offshore activities resulting from the leasing and exploration in the South Atlantic OCS are not likely to impact this snake. However, the expansion of port facilities or the

establishment of new support facilities, in areas other than those mentioned previously, may impact this species and will require reinitiation of consultation.

Should an oil spill reach the east coast of Florida, the habitat of the Atlantic salt marsh snake may be impacted by the oil or by the associated cleanup operations. The impact of oil on salt marsh snakes is not known, but oil pollution could significantly reduce available habitat for this species. However, the possibility of an oil spill resulting from leasing and exploration activities is negligible.

Therefore, it is my biological opinion that the leasing and exploration of the South Atlantic OCS is not likely to jeopardize the continued existence of this species. However, any activity or program which is funded, authorized, or conducted by a Federal agency, particularly activities associated with development/production or exploration activities in areas other than those identified previously, will require a Section 7 consultation if the Atlantic salt marsh snake may be affected.

Sea Turtles

Populations of the listed sea turtles have declined due to commercial overutilization of eggs and turtles, increased natural predation on eggs and hatchlings, incidental catches by commercial fishermen, and possibly littering of the seas (plastic bags give the appearance of jellyfish and can kill turtles if consumed).

The National Marine Fisheries Service (NMFS) has jurisdiction over listed sea turtles in the aquatic environment; onshore, they fall under the jurisdiction of FWS. Therefore, the following information on five sea turtles relates to impacts of leasing and exploration activities on onshore turtle habitat. NMFS will address turtles in the offshore environment.

Sea turtle nesting habitat may be impacted by oil spills and human disturbance resulting from OCS activities. Disturbance from development and other human uses of beaches is incompatible with successful sea turtle nesting. Sea turtle hatchlings erupt from the nest at night and are attracted by the moon reflecting on the ocean. Bright lights in the nesting beach areas could divert this movement away from the ocean, rendering the young turtles vulnerable to road traffic or predators.

The impacts of oil spills on sea turtles remain largely unknown, and much of the information presently available is the result of deductive reasoning. However, in the South Atlantic area, should an oil spill from an exploratory well occur, it is logical to conclude that it could harm adult and immature turtles which may accidentally ingest hydrocarbons with particulate matter. If turtles become contaminated by oil,

irritation or permanent damage to the eyes and respiratory system, and abnormal behavior might occur. If spilled oil were to reach nesting beaches, particularly during the nesting season, the nesting cycle and breeding behavior of adult turtles might be disrupted. The survival rate of oiled hatchlings would be greatly reduced. Cleanup operations on beaches could destroy existing nests; may create physical obstacles (deep tire tracks, sand piles, etc.) on the beach, thus preventing hatchlings from reaching the ocean; and/or could frighten gravid female sea turtles causing them to return to the ocean without nesting. Oiled beaches would become less attractive to nesting turtles. In addition, oil which has been absorbed by the sand could affect hatchability of turtle eggs in future years. As previously noted, there is a lack of data concerning the effects of an oil spill on nesting turtles. These data gaps need to be investigated in order to make realistic assessments of the impact of oil on sea turtles. However, since the probability of a large oil spill occurring during the exploratory phase is quite remote, this data is not required to complete this consultation.

The effect of development/production activities on sea turtles is not included, as those phases require separate consultation. It should also be noted that little information concerning the effect of oil spills and onshore development (particularly lighting) on nesting sea turtles and their habitats exists.

Kemp's Ridley Sea Turtle (Lepidochelys kempii)

The Kemp's Ridley sea turtle was originally listed in the Federal Register as Endangered on December 2, 1970. Critical Habitat has not been determined. It ranges in the western Atlantic Ocean from Nova Scotia and, possibly, Newfoundland south to Bermuda and west through the Gulf of Mexico to Mexico. Adults are restricted to the Gulf of Mexico, and nest primarily in Tamaulipas, Mexico. Immature Ridleys have been observed along the east coast of the United States and in the Florida Keys. Limited data is available regarding the habits of this turtle.

Kemp's Ridley turtles have been decimated by fishing, nest-robbing, and the slaughter of nesting females. The chances of survival are more precarious than those of any other sea turtle.

If an oil spill from an exploratory well were to reach the Florida Keys, it could harm adult and immature Ridleys as discussed above. However, the probability of a spill occurring during the exploratory phase is considered unlikely.

Since the Kemp's Ridley is not known to nest on beaches of the lower Atlantic Coast of the United States, the activities projected to result from proposed South Atlantic OCS leasing and exploration are not likely

to jeopardize the continued existence of this species or destroy or adversely modify nesting habitat essential to its survival and recovery. However, any activity or program authorized, funded or carried out by a Federal agency will require Section 7 consultation if the Kemp's Ridley turtle may be affected.

Hawksbill Sea Turtle (Eretmochelys imbricata)

The hawksbill turtle was originally listed in the Federal Register as Endangered on June 2, 1970. Critical Habitat has not been determined. Distribution in the Atlantic Ocean extends from southern Brazil to Massachusetts. Nesting occurs on scattered islands and shores generally between 25 degrees N and S Lat. In the conterminous United States there have been only two reported nestings in Florida. Nesting is random, probably without established nesting sites, and usually on undisturbed deep-sand beaches in the tropics.

Little is known of the hawksbill's behavior and population estimates are not available. Population numbers have declined to the point where its survival is in question. Many nesting beaches have been lost due to natural disasters (such as hurricanes and erosion), alteration of habitat, or commercial utilization by man. Throughout its range, the hawksbill is hunted for its shell and flesh.

An oil spill in the South Atlantic could cause degradation of nesting beaches in the Bahama Islands, disruption of normal feeding behavior, contamination of food, and mortality to immature and hatchling hawksbill turtles. Since there are only two reports of hawksbill turtles nesting along the South Atlantic coast of the United States, it is my biological opinion that the activities projected to result from proposed OCS leasing and exploration are not likely to jeopardize the continued existence of the hawksbill turtle or destroy or adversely modify nesting habitat essential to its survival and recovery. However, any activity or program authorized, funded or carried out by a Federal agency, will require Section 7 consultation if the hawksbill turtle may be affected.

Leatherback Sea Turtle (Dermochelys coriacea)

The leatherback turtle was originally listed as Endangered on December 2, 1970. Critical Habitat has been designated in the Virgin Islands and was published in the Federal Register on September 26, 1978. The distribution of the leatherback is worldwide. In the western Atlantic, it is found from Newfoundland to Argentina. Most nesting occurs in tropical waters. In the United States nesting is reported from Florida and there has been one nest reported from North Carolina. Florida

nesting occurs from Flagler Beach to Miami with the majority of nests recorded from Palm Beach. There appears to be a small population that nests regularly on Hutchinson Island in Martin County, Florida.

Since the possibility of an oil spill occurring during exploration activities is minimal, and onshore activities associated with OCS exploration are expected to occur in previously developed areas, it is my biological opinion that the activities projected to result from proposed OCS leasing and exploration are not likely to jeopardize the continued existence of the leatherback turtle or destroy or adversely modify nesting habitat essential to its survival and recovery. However, any activity or program authorized, funded or carried out by a Federal agency, particularly activities associated with development/production or exploration activities in areas other than those identified previously, will require Section 7 consultation if the leatherback turtle may be affected.

Loggerhead Sea Turtle (Caretta caretta)

The loggerhead sea turtle was listed as Threatened in the Federal Register on July 28, 1978. Critical Habitat has not been designated. The loggerhead is found throughout the Pacific, Indian, and Atlantic Oceans and the Caribbean and Mediterranean Seas. In the western Atlantic, it is found from Newfoundland to Argentina. The loggerhead wanders widely throughout the marine waters of its range. Large offshore populations have been recorded in the New York Bight, and presumably there are similar such concentrations in the South Atlantic where nesting is prevalent.

On the east coast, nesting has occurred on various barrier islands and beaches from Chincoteague National Wildlife Refuge (NWR), Virginia, south to the Florida Keys. Isolated nesting has been recorded as far north as New Jersey. Presently, its breeding range on the east coast of the United States is probably restricted to points south of Cape Lookout, North Carolina. The loggerhead is the most numerous and widespread of all the nesting sea turtles in the United States. The largest loggerhead nesting rookery on the east coast occurs at Cape Romain NWR, in South Carolina. The nesting season extends from April through August, with a peak in June.

The rapid development of beaches and coastal islands for home sites and recreational areas has destroyed much of its North American nesting habitat and has greatly reduced its population in the United States.

Since the possibility of an oil spill occurring during exploration activities is minimal, and onshore activities associated with OCS

exploration are expected to occur in previously developed areas, the activities projected to result from proposed OCS South Atlantic leasing and exploration are not likely to jeopardize the continued existence of the loggerhead turtle or destroy or adversely modify nesting habitat essential to its survival and recovery. However, any activity or program authorized, funded or carried out by a Federal agency, particularly activities associated with development/production or exploratory activities in areas other than those identified previously, will require Secion 7 consultation if the loggerhead turtle may be affected.

Green Sea Turtle (Chelonia mydas)

The green sea turtle was listed as Threatened in the Federal Register on July 28, 1978, in all of its eastern North American range except the State waters of Florida, where it is Endangered. Critical Habitat has not been determined.

This turtle is found throughout the world in tropical and semi-tropical waters. In eastern North America it is found from the coasts of Massachusetts to Mexico. Its known nesting in eastern United States is limited to Florida where it ranges from Cape Canaveral National Seashore southward with concentrations located on Merritt, Hutchinson, and Jupiter Islands, and Hobe Sound NWR.

The exploitation of the green turtle on both nesting beaches and feeding grounds has caused its decline. It has already disappeared from many beaches where it was once abundant. Economically, the green turtle is often considered the most important reptile in the world.

Since the possibility of an oil spill occurring during exploration activities is minimal, and onshore activities associated with OCS exploration are expected to occur in previously developed areas, the activities projected to result from the proposed South Atlantic OCS leasing and exploration are not likely to jeopardize the continued existence of the green turtle or destroy or adversely modify nesting habitat essential to its survival and recovery. However, any activity or program authorized, funded, or carried out by a Federal agency, particularly activities associated with development/production or exploratory activities in areas other than those identified previously, will require Section 7 consultation if the green turtle may be affected.

Brown Pelican (Pelecanus occidentalis)

The brown pelican was listed as Endangered in the Federal Register on October 13, 1970. Critical Habitat has not been designated. On the east coast the pelican ranges from North Carolina to the Florida Keys.

The North and South Carolina populations are small, and the Florida population contains 20,000 to 30,000 individuals.

These colonial nesters build their nests and raise their young on small coastal islands in salt and brackish waters. The nests are constructed of available vegetation and are located either in trees or on the ground at an elevation high enough to prevent nest flooding. The pelicans in Florida primarily nest from 1-10 meters above the high tide mark in mangrove trees. The clutch contains 2 to 3 eggs. Both parents share in the incubation of the eggs and the rearing of the young.

The nesting season varies with location. On the east coast of Florida, nesting begins in November-December. In South Carolina, nesting has been observed as early as March-April, but usually occurs in May.

The major food of the pelican is fish, including menhaden, mullet, sardines, and pinfish. The pelican catches these fish by flying low over the water and then plunge-diving to catch its prey. According to Schrieber, the productivity and survival of the pelican are related to fish availability.

The decline in the number of pelicans can be attributed to the wide use of pesticides which cause eggshell thinning; human disturbance of nesting colonies; damage from fishing hooks and line; decrease in food supplies; and malicious killing or maiming by humans.

Pelicans are susceptible to oil spills. Since brown pelicans dive for fish, their entire body can be coated with oil. This can cause direct mortality and may also result in a secondary impact by reducing the hatching success of eggs contaminated by oiled adults. Toxicological studies have indicated that small amounts of oil applied to an egg are toxic to the embryo. Food contamination, leading to illness or mortality, and/or reduced food supplies may also result from a large oil spill. If an oil spill were to reach an area used for feeding, nesting or loafing, a colony of pelicans could be decimated. However, the probability of a spill occurring as a result of the proposed leasing and exploration program is minimal.

The brown pelican is extremely susceptible to disturbance and habitat alteration of nesting areas. Disturbances cause nest desertion and egg loss; therefore, it is imperative to prevent disturbance of nesting colonies of brown pelicans. Of the ports considered in this consultation, there are brown pelican nesting colonies in relatively close proximity to Wilmington, North Carolina; Charleston, South Carolina; and Port Canaveral, Florida. Since the use of these areas is expected to be

restricted to previously developed sites, the impact to brown pelicans will be minimal.

Therefore, it is my biological opinion that the proposed leasing and exploration are not likely to jeopardize the continued existence of the brown pelican. However, any activity or program authorized, funded, or carried out by any Federal agency, particularly activities associated with development/production or exploration activities in areas other than those identified above, will require Section 7 consultation if it is determined that the brown pelican may be affected.

Bald Eagle (Haliaeetus leucocephalus)

The bald eagle was initially considered to have two distinct subspecies. The southern bald eagle was listed as an Endangered species in the Federal Register of March 11, 1967. The entire species was listed as Endangered in 43 of the conterminous 48 States and Threatened in the remaining 5 States on February 14, 1978. Bald eagle populations that occur within the area which may be impacted by this proposal are listed as Endangered. Critical Habitat has not been determined.

In the South Atlantic coastal area, bald eagles nest only in South Carolina and Florida. Nesting occurs from November to April in South Carolina, while in Florida some breeding activity may occur throughout the year.

South Carolina has 16 or 17 nesting territories which are located in Georgetown, Charleston, Beaufort and Colleton Counties. During the 1977-78 nesting season, Florida had at least 319 active nesting territories distributed throughout most of the State. The historical range of the eagle in Florida included the extreme eastern seaboard, but urbanization has forced the bulk of the population to move inland. There are presently only two sites with nesting activity east of the Atlantic Intracoastal Waterway - Merritt Island and Fisher Island, in Brevard and Dade Counties, respectively.

Eagles are opportunistic feeders. Fish constitute the bulk of their diet, but they will also feed on waterfowl and shorebirds, particularly sick or injured individuals, as well as carrion. Throughout most of the bald eagle's range, population decline has been largely attributed to the effect of pesticide ingestion (resulting in eggshell thinning) and indiscriminate shooting. Florida appears to be an exception, where the primary factor, at this time, is loss of habitat through urbanization.

Three potential sources of impact to the eagle from OCS leasing and exploration activities are disturbance to its nests resulting from

development of onshore facilities; the possibility of an oil spill reaching the coast and contaminating its food sources; and the possibility of an eagle coming in contact with oil and contaminating its eggs.

In Florida, the only known nests within the potential impact area covered by this consultation are located at Orange Park, in Clay County, west of the St. Johns River; on Merritt Island; and on Fisher Island. The Orange Park area is already in residential development and the possibility of oil facilities being constructed in this area are nil. The eagle nests on Merritt Island are located within the National Wildlife Refuge, which should preclude any development that would have an adverse impact on eagle nesting habitat. The nest on Fisher Island, a privately owned but undeveloped spoil island of approximately 220 acres in Dade County, is located near the center of the island. Onshore facilities are not likely to be located in Dade County; therefore, this nest should not be affected.

The eagle nests in South Carolina are in close proximity to the coast and occur on State-controlled lands which should preclude any development that would adversely impact eagle nesting habitat.

Since onshore facilities for leasing and exploration activities will be primarily those already in existence, and the possibility of an oil spill occurring during exploration activities is minimal, it is my biological opinion that these activities are not likely to jeopardize the continued existence of the bald eagle. However, the expansion of port facilities or the establishment of new support facilities in areas other than those mentioned previously may impact this species and will thus require the reinitiation of consultation. Further, any activity or program authorized, funded, or carried out by a Federal agency, particularly development/production activities, or exploration activities in areas other than those identified previously, which may affect bald eagles or their active nesting sites, will require additional Section 7 consultation.

Arctic and American Peregrine Falcon (Falco peregrinus tundrius and F. p. anatum)

The peregrine is a medium-sized falcon which has been listed as Endangered since 1970. Critical Habitat for F. p. anatum has been designated in California.

The principal cause of the peregrine's decline has been contamination by chlorinated pesticides. Other factors contributing to their decline include shooting, predation (by great horned owls in particular), egg collecting, disease, falconers, human disturbance at nesting sites, and loss of habitat to human encroachment.

The Arctic peregrine breeds in the North American tundra, and migrates along the east coast where it is the most common of the two subspecies. While a few pairs still breed in Labrador, the Eastern United States population of American peregrines is considered to have been extirpated. However, as a result of the captive breeding program at Cornell University, peregrine falcons have been reintroduced in the northeastern United States. There are indications that this reintroduction effort may be successful, and that someday breeding pairs may again occur in the Eastern United States.

During migration, coastal habitats are used extensively by peregrine falcons. Peregrines can also be found as far as 300 miles offshore during the migration period. Since they are capable of feeding while in flight, it is possible that spills which remain offshore can result in the oiling of peregrines or their prey. In addition, peregrines which rest on beaches during migration may become oiled. The probability of a spill occurring during exploration activities, however, is very small. Loss of onshore migratory habitat should not occur since new facilities are not expected to be constructed. The expansion of port facilities or the establishment of new support facilities in areas other than those mentioned previously, may impact this species and will require reinitiation of consultation.

Since existing facilities will be used and the potential for an oil spill resulting from exploration activities is small, it is my biological opinion that the proposed leasing and exploration activities on the South Atlantic OCS are not likely to jeopardize the continued existence of the American and Arctic peregrine falcons. However, any activity or program which is funded, authorized, or conducted by a Federal agency, particularly activities associated with development/production or exploration activities in areas other than those identified previously, will require Section 7 consultation if peregrine falcons may be affected.

Key Deer (Odocoileus virginianus clavium)

The Key deer was listed in the Federal Register as Endangered on March 11, 1967. Critical Habitat has not been designated. Loss of suitable habitat is the major reason for its decline. Auto collisions and over-hunting (in the past) have also contributed to reduced populations.

Key deer are restricted to the islands of the lower Florida Keys. They utilize a number of these islands but only those with a permanent supply of fresh water can support resident deer populations. Currently, the population is estimated at between 350 and 400 individuals with Big Pine Key and No Name Key supporting the largest numbers.

The Key deer is not likely to be affected by the exploration activities anticipated to result from the sales considered in this South Atlantic consultation. Onshore activities are most likely to occur in the port areas mentioned previously. If support facilities are located elsewhere, consultation is to be reinitiated to evaluate the specific development.

If an oil spill from an exploratory well was carried by the longshore currents into the Florida Keys, it could damage the red mangrove upon which the deer feed; thus degrading their habitat and food source. Deer could also become oiled as they swim between the islands. Since the possibility of a spill is remote, it is my biological opinion that leasing and exploration activities in the South Atlantic region are not likely to jeopardize the continued existence of the Key deer. However, any activity or program authorized, funded or carried out by a Federal agency, particularly activities associated with development/production or onshore actions in areas other than those identified previously, will require Section 7 consultation if the Key deer may be affected.

Other Listed Species

The following species were also considered during this consultation: Florida panther, Eskimo curlew, Everglade kite, Cape Sable sparrow, dusky seaside sparrow, Bachman's warbler, Kirtland's warbler, ivory-billed woodpecker, red-cockaded woodpecker, eastern indigo snake, Schaus' swallowtail butterfly, Bahaman swallowtail butterfly and Stock Island tree snail. Based upon their ecology and distribution, these species are not known to occur in areas where leasing and exploration activities resulting from this proposal could impact them. Therefore, it is my biological opinion that the leasing and exploration activities in the South Atlantic region are not likely to jeopardize the continued existence of the above listed species or destroy or adversely modify their Critical Habitats. However, any activity or program authorized, funded, or carried out by a Federal agency, particularly activities associated with development/production or onshore actions in areas other than those identified previously, will require Section 7 consultation if any listed species may be affected.

Cumulative Effects

The evaluation of the impacts of OCS oil and gas leasing and exploration activities in the South Atlantic on listed species must include consideration of the direct and indirect effects, together with the identifiable effects of actions that are interrelated or interdependent with the proposed activity or program. As previously indicated, the scope of

this Section 7 consultation includes all leasing and exploration activities related to the proposed OCS Sales 56 and 78 which appear in the Proposed OCS Oil and Gas Lease Sale Schedule dated June 1979.

Should exploration reveal significant amounts of hydrocarbons suitable for commercial exploitation, a separate Section 7 consultation must be initiated for all development and production activities. Finds of commercial magnitude in areas leased during Sales 56 and 78 may result in additional future lease sales. These future sales, will also require separate consultations on leasing and exploration activities. Thus, Endangered species considerations which might arise as a result of these cumulative effects (namely development/production and additional future lease sales) will be addressed in future consultations when more specific information will be available.

One possible interrelated onshore project is the proposed Brown and Root platform fabrication yard to be located on Virginia's Eastern Shore. If built, this facility would construct offshore platforms for use on the east coast. Currently this proposal has been dropped; however, commercially exploitable discoveries in the South Atlantic would create additional incentive to repropose the project.

In addition, increased boat traffic will result from commercial hydrocarbon discoveries. The magnitude of this increase will be dependent upon the size of the discoveries. However, any increase in boating activities in areas frequented by manatees is a potential source of conflict. If the boating recommendations referred to in the species account (above) are adhered to, much of this potential conflict will be resolved.

Advisory Statement

Activities along the South Atlantic coast that are not directly related to OCS Sales 56 and 78 and associated exploration activities, but are expected to occur, could have impacts on the environment similar to the effects of the proposed action. The Service is advising that the following activities, although not subject to this consultation, could affect listed species inhabiting the South Atlantic seaboard.

1. Increased boat traffic from all sources, including increased use associated with all facets of oil and gas development and production, as well as commercial shipping and recreational boating, would escalate impacts to coastal ecosystems. Of particular concern is the potential impact increased boat traffic would have on manatees (boat strikes).

2. Future projects to prevent beach erosion, dredging projects and port improvements will cause environmental concerns which may impact coastal listed species.

3. The possible sitings of liquified natural gas and refinery facilities may impact listed species. Impacts could result from the location of the facility and the transportation routes associated with the movement of the gas or oil from the offshore area to onshore facilities. Increased chronic oil pollution and the possibility of a large spill from either pipelines or tankers may affect local areas and listed species found in those areas.

4. Numerous coastal development projects will continue to reduce the habitat of many listed species. Particularly susceptible to this continuing problem are sea turtles whose nesting beaches are often physically destroyed or degraded to the point where nesting success is significantly reduced or eliminated.

Long-term increases of these and other activities, alone or in combination, may exceed the tolerance level of a listed species and may jeopardize its continued existence.

BLM and GS should be aware of these activities and their potential for impacting listed species. This potential should be considered during the planning of OCS development/production activities. Both agencies should expend every effort to meet their obligation to conserve listed species throughout all phases of OCS activities.

It is apparent that there is little information available concerning the impact of oil, and, in some cases, onshore development on various listed species. While applicable to all listed species in the area, this is particularly relevant to the manatee and the reptilian species. Studies to determine these impacts and to relate oil and gas activities to the conservation of listed coastal species will be necessary to complete consultation on the development/production phases of OCS activities in the South Atlantic. The Campeche oil spill provides an opportunity to study the effects of oil on listed species and their habitats.

<u>Conclusion</u>

Based on my consultation team's review of the above information and other information and data available to the Service, it is my biological opinion that the leasing and exploration activities associated with proposed OCS Sales 56 and 78 as outlined in the Project Description section above, are not likely to jeopardize the continued existence of the listed species considered herein or result in the destruction or adverse modification of their Critical Habitats. However, should the use of other onshore facilities not specifically discussed in this consultation be sought, reinitiation of Section 7 consultation will be

required. Consultation must also be reinitiated if there is any increased boating activity in areas of warm water discharge or congregation areas for manatees; or if vessels used in manatee habitats differ significantly in design from vessels which normally operate in those areas; or if new manatee concentration areas are discovered in routes used on a regular basis by vessels servicing offshore activities. Since it has been determined that development/production activities may affect listed species, Section 7 consultation will be required between GS and the Service before the development/production phase is entered. If a new species which may be affected should be listed, or additional pertinent information becomes available, or the project description, as discussed above, be changed, Section 7 consultation must be reinitiated. Any activity or program which is authorized, funded, or carried out by a Federal agency which may affect a listed species will require a Section 7 consultation. I would like to remind BLM and GS of their continuing responsibility under the Endangered Species Act to utilize their authorities, in compliance with the intention of the Act, to conserve listed species. In carrying out this responsibility, I am asking that you remain in close contact with Endangered Species personnel. This is particularly important in the approval of various plans, the development of oil spill contingency plans and during oil spill cleanup operations.

Robert B. Cook

Attachments

cc: Department of State
Regional Director, R-4
Jacksonville Area Office
Asheville Area Office
Consultation Team Members
Tom Loughlin, NMFS
Nancy Sweeney, OES

IN REPLY REFER TO:

United States Department of the Interior

1792 (542)

BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

SEP 17 1979

.Memorandum

To: Director, Fish and Wildlife Service

Through: Assistant Secretary, Land and Water Resources

From: Director, Bureau of Land Management

Subject: Endangered Species - Joint Consultation for U.S. South Atlantic Region

The Bureau of Land Management (BLM) and the U.S. Geological Survey are requesting a joint regional consultation on the Outer Continental Shelf (OCS) oil and gas program in the U.S. South Atlantic region. This regional consultation should consider all of the ongoing operations pertaining to oil and gas leasing and the permitting of pipeline rights-of-way from Key West, Florida to the Virginia-North Carolina border. In accordance with Section 7 of the Endangered Species Act, we requested a formal consultation and received a biological opinion on a previous South Atlantic lease sale (No. 43). Future oil and gas lease sales are scheduled to take place in this same general region. We feel that a joint consultation that addresses impacts of the regional OCS oil and gas program on endangered and threatened species will be a more efficient and economical approach than the existing agency-by-agency, sale-by-sale consultation procedure.

Enclosed is a list of the species for which we are requesting a formal consultation, and a copy of the final environmental impact statement for South Atlantic OCS lease sale No. 43 for use as reference material. Arrangements for a formal consultation meeting may be made through the New Orleans OCS Office, Bureau of Land Management, Hale Boggs Federal Building, Suite 841, 500 Camp Street, New Orleans, Louisiana 70130.

If you have any questions concerning this request, please contact Jacob Lehman in the New Orleans OCS Office (FTS 682-6541) or Ralph Ainger (BLM-542) in Washington, D.C. (FTS 343-6264).

Donald P. Truesdell

Enclosure

Species List

Key deer	Odocoileus virginianus clavium
West Indian manatee	Trichechus manatus
Florida panther	Felis concolor coryi
Eskimo curlew	Numenius borealis
Bald eagle	Haliaeetus leucocephalus
American peregrine falcon	Falco peregrinus anatum
Arctic peregrine falcon	Falco peregrinus tundrius
Everglade kite	Rostrhamus sociabilis plumbeus
Brown pelican	Pelecanus occidentalis
Cape Sable sparrow	Ammospiza maritima mirabilis
Dusky seaside sparrow	Ammospiza maritima nigrescens
Beachman's warbler	Vermivora bachmanii
Kirtland's warbler	Dendroica kirtlandii
Ivory - Billed woodpecker	Campephilus principalis
Red-cockaded woodpecker	Dendrocopos borealis
American alligator	Alligator mississippiensis
American crocodile	Crocodylus acutus
Atlantic salt marsh snake	Nerodia fasciata taeniata
Eastern indigo snake	Drymarchon corais couperi
Kemp's Ridley turtle	Lepidochelys kempii
Hawksbill turtle	Eretmochelys imbricata

Leatherback turlte	Dermochelys coriacea
Green turtle	Chelonia mydas
Loggerhead turtle	Caretta caretta
Schaus' swallowtail butterfly	Papilio aristodemus ponceanus
Behaman swallowtail butterfly	Papilio andraemon bonhotei

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
EGS-Mail Stop 630

OCT 1 1979

OCT 11 1979

Memorandum

To: Director, U.S. Fish and Wildlife Service

From: Director, Geological Survey

Subject: Formal Endangered Species Consultation--South Atlantic Sale No. 56 Area

In accordance with the provisions of Section 7 of the Endangered Species Act of 1973, as implemented by 50 CFR 402, we are requesting a joint formal consultation with your Bureau for Lease Sale No. 56 exploration activities. It is our understanding that the Bureau of Land Management has also requested consultation on this area for Lease Sale No. 56. A joint consultation would appear to measurably save staff time for all Agencies involved.

The following endangered and/or threatened species and their critical habitats may be affected by operations to be conducted in the Lease Sale No. 56 area under exploration plans approved by the Atlantic Area Oil and Gas Supervisor for Operations in the Eastern Region, Conservation Division of the Geological Survey: Florida manatee, _Trichechus manatus_; dusky seaside sparrow, _Ammospiza maritima nigrescens_; Bachman's warbler, _Vermivora bachmanii_; American alligator, _Alligator mississippiensis_; brown pelican, _Pelecanus occidentalis_; bald eagle, _Haliaeetus leucocephalus_; Arctic peregrine falcon, _Falco peregrinus tundrius_; and the leatherback, _Dermochelys coriacea_, hawksbill, _Eretmochelys imbricata_, Atlantic Ridley, _Lepidochelys kempii_, green, _Chelonia mydas_, and loggerhead, _Caretta caretta_, sea turtles.

Subject to your approval, as provided in 50 CFR 402.04(a)(3), it is requested that the range of activities considered in the consultation include the Outer Continental Shelf (OCS) oil and gas exploratory operations in the proposed tracts for leasing in Lease Sale No. 56. We have summarized previous endangered species consultations in an enclosure to this request.

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These previous biological opinions may or may not cover all of the necessary items for consultation on Sale 56 OCS exploration activities. Should this request for joint consultation meet with your approval, our staff will be prepared to participate in any meetings you may arrange.

J. S. Cragwall, Jr.
for H. William Menard

Enclosure

South Atlantic Area

Previous formal consultation concerning the effects of the proposed South Atlantic Lease Sale No. 43 upon endangered and threatened species and their habitats was requested from your Bureau by the Bureau of Land Management (BLM) in memoranda of February 9, 14, and 17, 1978. The following species were identified as Endangered or Threatened: Florida manatee, dusky seaside sparrow, Bachman's warbler, American alligator, brown pelican, bald eagle, Arctic peregrine falcon, and the leatherback, hawksbill, and Atlantic Ridley sea turtles. Based on the findings of a Fish and Wildlife Service (FWS) consultation team, the Director, FWS, furnished the Director, BLM, on February 11, 1978, a biological opinion which stated that "the proposed project is not likely to jeopardize the continued existence of the Endangered or Threatened species listed above or result in the destruction or adverse modification of habitats determined to be critical to them."

In a memorandum of February 27, 1978, the Director, FWS, informed the Director, Geological Survey (GS), that, as a result of formal Section 7 consultation with BLM on Lease Sale No. 43, it was determined that "exploration and development of lease areas subsequent to the sale may affect Endangered or Threatened species or result in the destruction or modification of their Critical Habitats." Examples given of activities which may affect listed species include increased boating activity due to crew and service vessels in the critical habitat of the Florida manatee, or location of onshore facilities sufficiently close to the critical habitat of the dusky seaside sparrow to adversely impact that species. The Director, FWS, stated that these and similar activities permitted through approval of exploration and development plans by GS would require the initiation of formal Section 7 consultation by GS.

In a memorandum of February 9, 1978, the Director, BLM, requested formal consultation from the Regional Director, Southeast Region, National Marine Fisheries Service (NMFS), on proposed Lease Sale No. 43. The Regional Director furnished his biological opinion in a memorandum of March 6, 1978. Listed species considered in the opinion included the humpback, right, sei, blue, finback, and sperm whales and leatherback, hawksbill, and Atlantic Ridley turtles. Two species proposed to be listed at that time were also considered--the green sea and loggerhead sea turtles. In addition to the sale itself, the biological opinion took into consideration the full range of activities resulting from the sale, including exploration, development, and production. The opinion stated that "the proposed project is not likely to jeopardize the continued existence of the Endangered

or Threatened Species listed above or result in the destruction or adverse modification of habitats determined to be critical to them."

The Regional Director indicated that BLM must reinitiate Section 7 consultation should new information reveal impacts of the identified activity that may affect listed species or their habitats; or the activity is subsequently modified; or a new species is listed that may be affected.

As of July 28, 1978, FWS and NMFS added the green sea turtle as a threatened species, except that the Florida and Mexican Pacific coast breeding populations are determined to be endangered species. The loggerhead sea turtle was added as a threatened species as of that date.

In memoranda of August 17, 1978, and October 19, 1978, BLM and GS, respectively, requested formal consultation from FWS on these species for oil and gas operations in the Sale 43 area. A joint formal consultation on these species of sea turtles was held between FWS, GS, and BLM on February 6, 1979. No formal consultation was requested from NMFS because NMFS covered these two species of turtles in its biological opinion of March 6, 1978, which resulted from formal consultation with BLM for Sale 43 and subsequent oil and gas operations. By mutual agreement between BLM and GS, these consultation requests were combined and one biological opinion furnished by the Director, FWS. The Director, FWS, informed the Director, GS, by memorandum, that, as a result of the joint formal Section 7 consultation, it was determined that the "leasing and exploration for oil and gas in the Outer Continental Shelf (OCS) Lease Sale No. 43 area are not likely to jeopardize the continued existence of the Endangered green sea turtle and Endangered and Threatened loggerhead sea turtle or destroy or adversely modify the nesting habitat essential to their survival and recovery." The Director, FWS, cautioned that he had "identified the development and production of OCS resources coupled with associated onshore development as a situation which may impact nesting sea turtles," and, therefore, these phases of OCS activity will require additional Section 7 consultation between GS and FWS.

In Reply Refer To:
FWS/OES 375.4
BLM/GS 79-4

OCT 29 1979

Memorandum

To: Director, Bureau of Land Management

From: Acting Director

Subject: Section 7 Consultation - Regional Consultation for OCS Oil and Gas Leasing in the South Atlantic

We have received your joint request with the Geological Survey (GS) for a regional Section 7 consultation on the OCS oil and gas leasing program in the South Atlantic area (Key West, Florida to the Virginia-North Carolina border). As in the past, the consultation will consider the leasing and exploration for oil and gas on the South Atlantic OCS.

Because of the complexity of the consultation, I am appointing a Section 7 consultation team to carry out the consultation process with BLM and GS. The following representatives are hereby appointed to the consultation team: Jack Edmundson, Team Leader, Office of Endangered Species (OES); Dan James, OES; Jim Michaels, OES; Dick Bailey, Region 4; Jim Baker, Jacksonville Area Office; Bob Currie, Asheville Area Office; and Lee Barclay, Charleston, South Carolina.

Through discussions with BLM and GS staff members it has been decided that the consultation team will meet with BLM and GS representatives in the OCS Office in New Orleans, Louisiana on October 30, 1979. Additional correspondence concerning this matter should be directed to Jack Edmundson, Office of Endangered Species (FTS 235-2760).

cc: Regional Director, R-4
Jacksonville Area Office
Asheville Area Office
Charleston Ecological Services Field Station

/sgd./Robert S. Cook

cc: Directorate Reading File
DD Chron File
AFA File

FWS/OES:JEdmundson:sm 9/28/79 retyped 10/9/79 and 10/26/79
235-2760

ENDANGERED SPECIES CONSULTATION

for the South Atlantic OCS

New Orleans, Louisiana

October 30, 1979

Attendees

Becky Metz	USGS-Wash. D.C.
Ben Jarvi	" "
Bob Kent	" "
Sie Ling Chiang	USGS- Reston, Va
Jack Edmundson	FWS-Wash.,D.C.
Daniel James	" "
Jim Michaels	" "
Ralph Ainger	BLM-Wash.,D.C.
Jim Baker	FWS-Jacksonville, FL
Robert Currie	FWS-Asheville, N.C.
Lee Barclay	FWS-Charleston, S.C.
Dick Bailey	FWS-Atlanta, GA
Ken Adams	BLM-N.O. OCS Office
D. R. Ekberg	NMFS-St. Petersburg, FL
Thomas Loughlin	NMFS-Wash.,D.C.
Chuck Oravetz	NMFS-St. Petersburg, FL
Jake Lehman	BLM-N.O. OCS Office

In Reply Refer To:
BLM/GS-79-4

DEC 1 4 1979

MEMORANDUM

To: Director, Bureau of Land Management
Director, U.S. Geological Survey

From: Acting Director, U.S. Fish and Wildlife Service

Subject: Time Extension for Section 7 Consultation on Oil and Gas Leasing and Exploration Activities in the South Atlantic Region

On September 20, 1979, I received a request for joint Section 7 Endangered Species Consultation relative to oil and gas leasing and exploration activities in the South Atlantic Region. During the course of this consultation, it has been necessary to examine the impacts of the proposed OCS activities on 27 listed species. Because of the complex nature of this consultation and the time constraints imposed on the Service as a result of the inability of our agencies to meet soon after the initiation of consultation, we find it necessary to extend the consultation period to January 18, 1980. This extension has been tentatively agreed to by field personnel, therefore, no response to this memorandum is necessary unless you disagree with the extension.

If you have any questions regarding this matter, please contact Jack Edmundson in the Office of Endangered Species (FTS 235-2760).

/sgd./Robert S. Cook

cc: Directorate Reading File
DD Chron File
AFA File

FWS/OES:JEdmundson:sm 235-2760 12/11/79

In Reply Refer To:
BLM/GS-79-4

MEMORANDUM

JAN 17 1980

To: Director, Bureau of Land Management
Director, U.S. Geological Survey

From: Associate Director, U.S. Fish and Wildlife Service

Subject: Time Extension for Section 7 Consultation on Oil and Gas Leasing and Exploration Activities in the South Atlantic Region

We are requesting a time extension for the above referenced Section 7 consultation. New information indicates that the U.S. Geological Survey (GS) cannot place the restrictions we feel are needed to insure protection of the Florida manatee in a Notice to Lessees. Therefore, other avenues must be considered. To accomplish this, we wish to extend the issuance date of the biological opinion to March 14, 1980.

If this date is unacceptable, please contact Jack Edmundson, Office of Endangered Species (FTS 235-2760) as soon as possible.

(Sgd.) Ronald E. Lambertson

c: Directorate Reading File
DD Chron File
AFA File
FWS/OES:NSwenney:sm 1/15/80

The biological opinion from National Marine Fisheries Service for this proposal had not been received when this DEIS was printed. It will be included in the FEIS if available.

Until the NMFS biological opinion for this proposal is received, the opinion printed in the 43 FEIS will be considered as applicable for this proposal.

APPENDIX C

OIL SENSITIVE AREAS OF THE SOUTH ATLANTIC

APPENDIX C

OIL SENSITIVE AREAS OF THE SOUTH ATLANTIC SEASHORE

The following table describes in some detail areas and features of particular concern should an offshore oil spill reach the South Atlantic seashore. It was our intent to include only the ocean front resources likely to absorb the initial impact of offshore spills coming ashore; however, some special resource areas located behind the barrier islands and inshore of coastal inlets and sounds have been included at the request of potentially affected states. The table follows a north to south progression, listing and describing principal geographic features within noted political boundaries. Special management units and incorporated towns associated with the shorefront geographic features are identified. Information on management, ownership, and areal and linear extent of some land and water resources is provided as well as noting what is believed to be the most sensitive concerns and uses associated with the areas identified that may be affected by oil spills. Seasonal implications are noted where appropriate.

This table was designed as an aid to impact analyses and can be correlated with figure 6 and table 13 of Appendix D, which lists the probabilities of oil spills impacting coastal county segments. Although designed for impact analysis, this table could be useful in contingency planning for spill containment and clean up. Many of the areas described in this table are graphically depicted on visual 4 associated with this environmental statement.

The information in this table was compiled by the Center for Natural Areas, the same contractor responsible for providing BLM a literature update on unique and endangered environments of the South Atlantic coastal area (CNA, Chapter XVIII, 1979).

The U.S. Fish & Wildlife Service has contracted for an ecological inventory to provide the latest information on critical and sensitive resources for the entire U.S. Atlantic coast. This inventory is scheduled for completion in August 1980, the final product will graphically display (1:250,000) similar information as included in this appendix.

"KEY TO ABBREVIATIONS"

Designations Key

AP	- Aquatic Preserve
CT	- Canoe Trail
CH	- Critical Habitat
EEL	- Environmentally Endangered Lands
ES	- Estuarine Sanctuary
GMA	- Game Management Area
HPS	- Heritage Preservation Sites (State)
HSS	- Hallmark Status Sites
MNA	- Managed Natural Area
MS	- Marine Sanctuary
NA	- Natural Area
NF	- National Forests
NHP	- National Heritage Program Area
NHS	- National Historic Site
NM	- National Monument or Memorial
NMP	- National Military Park
NNL	- National Natural Landmark
NP	- National Park
NRA	- Natural Resource Area
NS	- National Seashore
NWA	- National Widerness Area
NWR	- National Wildlife Refuge
PHA	- Public Hunting Area
POG	- Public Oyster Grounds
RA	- Restoration Area
RNA	- Research Natural Area
SF	- State Forest
SGL	- State Game Land
SHS	- State Historic Site
SNA	- State Natural Area
SNYA	- State Nursery Area (N.C.)
SP	- State Park
SRA	- State Recreation Area
SSA	- State Shellfish Area
SSSA	- Special Shellfish Seed Areas or Special State Shellfish Ground
SWR	- State Wildlife Refuge
WMA	- Wildlife or Waterfowl Management Area

Status ( ) Key

E	- Eligible
GAPC	- Geographic Area of Particular Concern
P	- Proposed
UC	- Under Consideration
NA	- Not Applicable
D	- Deferred for Study in Future
P&CD	- Private & Commercial Development

Designators ( ) Key

FCER	- Federal Committee on Ecological Reserves
GHT	- Georgia Heritage Trust
IBP	- International Biological Program
NAS	- National Audubon Society
NCMR	- N.C. Division of Marine Resources
NCPR	- N.C. Division of Parks and Recreation
NCWRC	- N.C. Wildlife Resources Commission
NHP	- Natural Heritage Program
LHS	- Liberty County Historical Society
SAF	- Society of American Foresters
SCHPB	- S.C. Heritage Preservation Board
SCWMRD	- S.C. Wildlife & Marine Resources Department
SCPRT	- S.C. Division of Parks and Recreation
SCSA	- Soil Conservation Society of America
TNC	- The Natural Conservancy
USFWS	- U.S. Fish & Wildlife Service
USNPS	- U.S. National Park Service
USCOE	- U.S. Army Corps Engineers
YMS	- Youth Museum of Savannah

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
NORTH CAROLINA										
Currituck Co										
Currituck Sound	Bay			Boating, fishing, waterfowl hunting	Public/USFWS		NA			Waterfowl (S,F,W); major waterfowl hunting (F); bald eagle & peregrine falcon (F); major loon wintering.
		Mackey I. NWR		Wildlife observation	Public/USFWS	2873		NA	2024	Waterfowl (S,F,W).
		Currituck NWR-UC		Hunting, wildlife observation	Public/NCMR					Waterfowl
Albermarle Sound	Bay			Boating, fishing, waterfowl hunting	Public/NCWRC		NA			Major spawning area; Herring, striped bass, also crab, clam, oyster;
Camden Co.										
North River	River mouth	N. River SGL		Waterfowl hunting, sport fishing	Public/NCWRC	3533	NA	14	NA	Waterfowl (S,F,W); hunting (F).
Martin Co.										
Roanoke River	River mouth	Roanoke River Marshes NHP-HC		Waterfowl hunting	Public & Private/NCMR & Private	400		NA	NA	Waterfowl Area (S,F,W).
Dare Co.										
Roanoke Island	Estuarine I.	Fort Raleigh NM		Tourism	Public/USNPS	49		2		Shoreside Historic Theatre (Su).
			Manteo	Tourism and P&CD	Priv & public/Priv & public		Yes			Wading bird rookery
	Bay	Shallowbag Bay SNYA		Fishery nursery area	Public/NCMR					Fishery nursery area
	River mouth	Broad Creek SNYA		Fishery nursery area	Public/NCMR					Fishery nursery area
Bodie Island	Barrier Beach/Peninsula			Tourism, bathing	Private/private					Intensive rec. beach (Su); Sport fishing (S,Su,F)

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
(Bodie Island)			Corolla Duck, Kill Devil Hills, Kitty Hawk, Nags Head		Private & public/Private & public		Yes			Intensive rec. beach (Su); sport fishing (S,F,W).
	Barrier Beach	Jockey's Ridge SP		Tourism, ground water	Public/NCPR	109	NA	1	NA	Largest sand dune on Atlantic Coast, also a NNL.
Hatteras Island	Barrier Is.			Tourism, bathing, sport fishing	Public/USFWS	6459	82		890	Intensive recreation beach (Su); major loon, grebe, cormorant, scoter migration route (S,F-just off shore) major shorebird area (red knot -F, Wilsons plover-nests).
	Barrier Is.	Pea Is. NWR		Waterfowl mgt sport fishing	Public/USFWS	2394	12.9	32	166	Major area for waterfowl (S,F,W); sport fishing (S,Su,F); Brown pelican, major peregrine falcon (F); wading bird rookery (S,Su); also a NWA=73 ha, 16 ha Marsh, also a NHP.
	Barrier Is.	Cape Hatteras NS		Tourism, bathing, sport fishing	Public/USNPS	11400*	28	NA	NA	Swimming (Su); Surf fishing (S,Su,F); Loggerhead turtle nesting (see Oregon Inlet)* Acreage is for total CHNS, including Ocracoke Island.
			Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, Hatteras		Private & public/Private & public		Yes			Intensive rec. beach (Su).
Hyde Co. Ocracoke Is.	Barrier Is.			Tourism, sport fishing, wildlife observation	Public & private/USNPS & private	1,862	26			Intensive rec. beach (Su); Brown pelican nesting (S,Su); major loon, grebe & cormorant migration route (S,F).
	Barrier Is.		Ocracoke	Tourism & P&CD	Private & public/Private & public		Yes			See also CHNS above.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
(Hyde Co.) Bird Island	Estuarine I.			Wildlife mgt	Public/USNPS	190	NA			Wading bird colony (S,Su).
Raleigh Bay	Ocean	Monitor Marine Sanctuary		Historic Ap-preciation	Public/NOAA					Historic value; Major Pelagic bird concentration area.
Pamlico Sound	Bay			Hunting, trap-ping, boating, fishing, agri-culture	Public/NCMR					Most important waterfowl area (S, Su, F) in N.C.; Furbearers.
	River mouth	Long Shoal R. SNYA		Fishery nur-sery mgt	Public/NCMR		NA			Fishery nursery area.
		Fair Creek SNYA		Fishery nur-sery mgt	Public/NCMR		NA			Fishery nursery area.
		Middletown Cr. SNYA		Fishery nur-sery mgt	Public/NCMR		NA			Fishery nursery area.
Wysocking Bay	Bay			Waterfowl hunting	Public/NCWRC		NA			
		Gull Rock SGL		Waterfowl hunting	Public/NCWRC & Private	7631	NA	13	NA	Waterfowl (S,F,W); hunting(F); oys-ters.
		Wysocking Bay SNYA		Fishery nur-sery mgt	Public/NCWRC & Private		NA			Fishery nursery area.
		Juniper Bay SNYA		Fishery nur-sery mgt.	Public/NCWRC & Private		NA			Fishery nursery area.
Swanquarter Bay	Bay	Swanquarter NWR		Waterfowl mgt	Public/USFWS	6273	NA	96	3238	Waterfowl (S,F,W); bald eagle, Am. alligator, oysters, crabs; also, a NWA=3642 ha; also NHP-UC 3677 ha.
		Swanquarter Bay SNYA		Fishery nur-sery mgt	Public/NCMR		NA			Fishery nursery area.
		Rose Bay SNYA		Fishery nur-sery mgt	Public/NCMR		NA			Fishery nursery area.
		Spencer Bay SNYA		Fishery nur-sery mgt	Public/NCMR		NA			Fishery nursery area.
		Abels Bay SNYA		Fishery nur-sery mgt	Public/NCMR		NA			Fishery nursery area.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS: Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
(Swanquarter Bay)	River mouth	Fortescue Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Slade Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Pungo Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Goose Cr. SGL		Waterfowl hunting	Public & private/Public & private	3075	NA	37		Waterfowl (S,G,W); hunting (F); oysters.
Beaufort Co. Pamlico River	River mouth	Goose Cr. SP		Tourism, bathing	Public/NCPR	510	NA	16	NA	also a NHP-UC=150 ha.
		Goose Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		North Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Oyster Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Bay	Mouse Harbor SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Big Porpose Bay SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Middle Bay SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Jones Bay SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	River mouth	Mason Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Moore Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Small tributaries from Bell Pt. to Ball Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
(Pamlico R.)	River mouth	Ball Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Cabin Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Bay	Bonner Bay SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Rock Hole SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	River mouth	Dump Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Tributaries E. of IWW at Gales Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Gales Cr. & Tributaries		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Tributaries between IWW & Bear Cr.SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Bear Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Little Bear Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Tributaries to Bay R. from Petty Pt. to Sanders Pt.SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Smith Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Chapel Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Bay	Swindell BaySNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
Craven Co.										
Neuse River	River mouth			Sport fishing	Public/NCMR		NA			Major shrimping area.
		Swan Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Broad Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Orchard Cr.SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Whittaker Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Oriental SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Bay	Croatan NF		Forestry, wildlife mgt	Public/ USFS & NCWRC	62729		NA	NA	Waterfowl, S,F,W); hunting (F); also SGL=12353 ha. (26km bay shore).
	Estuarine I	Lukens I. SGL		Waterfowl, wildlife mgt	Private/NCWRC & International Paper	4484	NA			Waterfowl hunting (F).
	River mouth	Clubfoot Cr.SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Adams Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Garbacon Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Brown Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Bay	Turnagain Bay SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	River mouth	creek between long Bay & Turnagain Bay		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Cr. between Long Bay & Thorofare Bay		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
<u>Carteret Co.</u>										
Core Banks	Barrier Is.	Cape Lookout NS		Tourism, hunting, fishing, bathing, shellfishing, boating, wildlife management	Public/USNPS	11493*	80	NA	4533	Intensive rec beach (Su); Surf fishing (S,Su,F); Loggerhead Turtle (Su); Peregrine Falcon (F); wading bird rookery (Su); Hard clams, oysters, also a NWA=5350 ha. 56 km= Ocean shore; also a NH-UC=9623 ha.*includes Shackleford Banks & Back Bay acreage.
Portsmouth I.	Barrier Is.		Portsmouth	Tourism, P&CD	Public/USNPS	2009	93			(See C.L.N.S.).
Core Sound	Bay			Boating, fishing	Public/USFSW		NA			Bay scallops, <u>major</u> shrimping area.
	Bay	Cedar Is. NWR		Waterfowl mgt	Public/USFWS	5059		8	4047	Waterfowl (S,F,W); oysters, crabs, also a NWA=73 ha.; also a NHP=2529ha.
		Cedar Is. Bay SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	River mouth	Lewis Cr.SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Bay	Thorofare Bay SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Bay	Nelson Bay SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	River mouth	Cedar Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	River mouth	Oyster Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Bay	Jarrett Bay SGL		Waterfowl hunting	Private/NCWRC & Weyerhouser Co.	(see Lukins Island above)				
	Bay	Jarrett Bay Area SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
Shackleford Channel	Inlet			Boating	Public/NCMR		0.5	7.5		
Shackleford Banks	Barrier Is.			Tourism, Fisheries	Private & public/USNPS & private	1133	14.5	19.3		(see C.L.N.S. above)

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
Beaufort Inlet	Inlet		Morehead City	Seaport	Private & public/Private & public					
Back Sound	Bay			Boating, fisheries	Public/NCMR		NA			Waterfowl (S,F,W)& rail hunting (F); major waterbird area (especially Dunlin (F,W), cormorant (W,S).
	River mouth	Straits SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		North River SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Newport R. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
	Estuarine I.	Bird Shoal POH		Wading bird mgt	Public/TNC		NA	14.5		Wading bird rookery (S,Su); (see C.L.N.S).
			Harkers Island	Recreation	Private & public/Private & public		NA			
Bogue Banks	Barrier Is.			Tourism	Public/NCPR	2590	40	40	1133	Waterfowl & rail hunting (F); Tourism (S,Su,F).
		Fort Macon SP*		Tourism	Public/NCPR	156	3	3		*also on Bogue Sound.
			Atlantic Beach, Salter Path, Indian Beach, Emerald Isle	Tourism	Private & public/Private & public		Yes			Intensive rec beaches (Su); salt marshes.
Bogue Sound	Bay			Tourism	Public/NCMR					Bay scallops, major shrimping area.
	Barrier Beach	Theodore Roosevelt NA-SP		Shellfish mgt research, education	Public/NCMR, NCPR	107		2	NA	Carteret Marine Center; Oysters, hard clams, wading bird rookery; also a NNL-UC.
	River mouth	Gales Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Broad Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Goose Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Archer Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
Bogue Inlet	Inlet			Boating	Public/NCMR					
Onslow Co.										
White Oak Riv	River mouth		Swansboro	Sport fishing Recreation	Public/NCMR					
		White Oak R. Wild & Scenic River-UC		Sport fishing Boating	Public/NCMR			70	NA	Atlantic Sturgeon, major shrimping area; also a NHP-UC. (See Croatan NF)
		N. White Oak R. SHYA		Fishery nursery mgt.	Public/NCMR					Fishery nursery area.
Bear Island	Barrier Is.			Recreation	Private/private		4.9	6.6		
Bear Inlet	Inlet			Recreation	Public/NCMR		1.4			
	River mouth	Queen's Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Bear Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
Onslow Bay	Bay			Sport fishing, boating	Public/NCMR					
Hammock Beach	Barrier Is.			Fishing, recreation	Public/NCPR	809	6	NA	449	Intensive rec. beach (Su); oysters.
		Hammock Beach SP		Public Recreation	Public/NCPR	361	5		74	Swimming & sport fishing (Su); outstanding sand dunes; also a NNL-UC.
Onslow Beach			Onslow Beach	Recreation	Private & public/Private & public	992	18	NA	202	Intensive rec beach (Su).
New River Inlet	River Mouth			Sport fishing	Public/NCMR		0.9			
	Bay	Salliers Bay SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
	River mouth	Hellgate Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Wards Channel SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		New River SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
(New River Inlet)	Bay	Chadwick Bay SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
Pender Co.										
Topsail (Ashe Island) Beach	Barrier Is.			Tourism and P&CD	Private & public/Private & public	3521	35	NA	2824	Intensive rec beach (Su).
		Topsail SP-UC	Del Mar Beach, Surf City, Topsail Beach	Tourism	Private & public/Private & public		yes			Intensive rec beach (Su).
	River mouth	Virginia Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
	Bay	Topsail Sound SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Mallard Bay Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
	River mouth	Howard Channel SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Long Pt. Channel SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Futch Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Page's Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
	Bay	Shell Is. Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
	River mouth	Howe Cr. (Moore Cr.) SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Bradley Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Lee Island	Barrier Is.			Recreation	Private/private	202	3	NA	101	
"No Name" Island	Barrier Is.			Recreation	Private/private	425	4	NA	304	
Figure Eight Island	Barrier Is.			Recreation & P&CD	Private & public/Private & public	546	5	NA	316	
New Hanover Co										
Wrightsville Beach	Barrier Is.		Wrightsville Beach, Sea Breeze	Recreation & P&CD	Private & public/Private & public	688	7	NA	445	Intensive rec. beach (Su); major cormorant migration route (S,F).
		Wrightsville Beach Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
Masonboro Beach	Barrier Is.			Recreation	Private/Private	672	13	NQ	567	Oysters.
		Masonboro SP		Public recreation	Public/NCPR	43	1	1	NA	Sport fishing, boating; also a NHP-UC, and SNA
	Ocean	Masonboro Reef NHP-UC		Sport fishing						Major sport fishing area.
	Bay	Myrtle Grove Sound Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
Carolina Beach	Barrier I.		Carolina Beach	Recreation, Tourism, P&CD	Private & public/Private & public	2853	35	NA	364	Intensive rec. beach (Su).
		Carolina Beach SP		Public recreation	Public/NCPR	704	NA	8	364	Intensive rec. beach (Su).
Kure Beach	Mainland Beach		Kure Beach	Recreation & Tourism, P&CD	Private & public/Private & public		Yes			Intensive rec. beach (Su).
		Fort Fisher SRA-UC		Public recreation	Public/NCPR					Boating, bathing, sport fishing (Su)
Smith (Bald Head) Is.	Barrier Is.			Recreation	Private/private	5250	16	NA	4168	Intensive rec beach (Su); Loggerhead turtle nesting (Su).

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
(Smith-Bald Head-Island)		Bald Head Is. Creeks SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area, oysters.
		Smith Is. NNL			Public/USNPS					Also a SNA-UC.
Brunswick Co. Cape Fear	Mainland Barrier Is.			Recreation	Private/Private					Intensive rec. beach(Su).
Cape Fear Riv.	River mouth		Southport, Wilmington	Sport fishing	Public/NCMR					Major shrimping & striped bass spawning area; Am. alligator, manatee, bald eagle nesting (S,Su); Atl Sturgeon, major shorebird wintering (F,W) (especially oystercatcher, plover, yellowlegs, major brown pelican summering area). Wilmington is a major port.
	River mouth	Cape Fear R. Area SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		The Basin SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Walden Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Dutchman Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Denis Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Piney Pt. Cr. SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
		Oak Is. Area SNYA		Fishery nursery mgt	Public/NCMR		NA			Fishery nursery area.
Lockwoods Folly Inlet	River mouth	Davis Creek SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
(Lockwoods Folly Inlet)	River mouth	Davis Canal SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Lockwoods Folly River SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
Battery Island	Barrier Is			Wildlife mgt	Public/NCSP, USCOE	10	NA			Major wading bird rookery (S,Su); also, (NNL-UC).
Long Bay	Ocean			Boating, fishing	Public/NCMR					
Long Beach	Barrier Is.		Long Beach	Tourism, P&CD	Private & public/Private & public		Yes			Intensive recreation beach (Su); Salt marsh.
Yaupon Beach	Barrier Island		Yaupon Beach	Tourism, P&CD	Private & public/Private & public		Yes			Intensive rec. beach (Su).
Holden Beach	Barrier Is.		Holden Beach	Tourism, P&CD	Private & public/Private & public	809	12.1	NA	202	Intensive recreation beach (Su).
Ocean Isle Beach	Barrier Is.		Ocean Isle Beach	Tourism, P&CD	Private & public/Private & public		Yes			Intensive rec. beach (Su).
Hales Beach	Barrier Is.			Tourism, P&CD	Private & public/Private & public	809	11	NA	210	Intensive rec. beach (Su).
Sunset Beach	Barrier Is.			Tourism, P&CD	Private & public/Private & public	809	4	NA	405	Intensive rec. beach (Su).
	River mouth	Shallotte Inlet Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Shallotte Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Saucepan Cr. SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Old Channel Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Little River Inlet	River mouth			Sport fishing	Public/NCMR					Important Estuary.
		Gause Landing Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Eastern Channel Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Big Narrows Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Mad Inlet Area SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.
		Calabash River SNYA		Fishery nursery mgt	Public/NCMR					Fishery nursery area.

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
SOUTH CAROLINA										
Horry Co.										
Long Bay	Ocean			Boating, Fishing	Public/SC WMRD					
Little River Inlet	River Mouth	*		Sport Fishing	Public/SC WMRD					Important estuary system (*see Little River Inlet N.C.)
Waites Island	Barrier Island			Recreation	Private/private	316	4	NA	168	
Bird Island	Barrier Island			Recreation	Private/private	468	1.6	NA	445	
Oak Island	Barrier Island			Recreation	Private/private	2428	21	NA	567	
	Mainland Beach		Cherry Grove Beach, Ocean Drive, Crescent Beach	P&CD and Recreation	Public/public		yes	NA		
		Cherry Cove POG		Shellfish mgt.	Public/SC WMRD					Oysters
N. Myrtle Beach	Mainland Beach		N. Myrtle Beach	Recreation and P&CD	Private & pub-lic/Private & public		34	NA		Intensive rec. beach (Su) Sports fishing pier (S,Su)
Myrtle Beach	Mainland Beach		Myrtle Beach	Recreation and P&CD	Private & pub-lic/Private & public		25	NA		Intensive rec. beach (Su) Sports fishing pier (S,Su)
		Myrtle Beach SP		Tourism	Public/SC PRT	126	2	NA		Intensive rec. beach (Su) Sports fishing pier (S,Su); recognized by IBP as a RNA
Surfside Beach	Mainland Beach		Floral Beach Surfside Beach	Recreation and P&CD	Private & pub-lic/Private & public		3.	NA		Intensive rec. beach (Su)
Garden Beach	Mainland Beach		Garden City	Recreation and P&CD	Private/public Private/public		6	NA		Intensive rec. beach (Su)Sports fishing pier (S,Su,F)

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
Georgetown Co.										
N. Murrels Inlet	Estuary Inlet	N. Murrels Inlet POG		Shellfish mgt	public/SC WMRD					Important Estuary, oysters (GAPC)
Murrels Inlet	Estuary Inlet	Clam Bank Flats POG		Shellfish mgt	public/SC WMRD					Oysters (GAPC)
	River mouth	Alston Cr. POG		Shellfish mgt,	public/SC WMRD	0.2				Oysters (GAPC)
	Barrier Island	Huntington Beach SP		Tourism	public/SC WMRD	1012	5		650	Intensive rec. beach (Su); major scoter (duck) migration route (S,F) Recognized by IBP as a RNA; also a GAPC
Litchfield Beach	Barrier Island			Recreation	Private/private		2			Intensive rec. beach (Su); major loon wintering area
Pawley's Beach	Barrier Island			Recreation	Private/private		4			Intensive rec. beach (Su); major loon wintering area
Debidue Beach	Barrier Island			Recreation	Private/private					Private resort beach (Su)
North Inlet	Estuary Inlet			Sport fishing	Public/ SC WMRD					Important research site
Waccamaw River	River mouth			Sport fishing	Public/SC WMRD					Wading bird rookery (S,Su)
		Sam Worth (Big Pee Dee) GMA		Waterfowl hunting	Public/SC WMRD	516				Waterfowl (S,F,W)hunting (F); recognized by IBP as a RNA (GAPC)
		Hobcaw Barony Plantation RNA		Research & education	Private/private					University of SC Reserve (Belle Baruch); recognized by IBP as a RNA
			Georgetown	Seaport	Private & public/Private & public					Important fishing port
Winyah Bay	Bay/River Mouth			Sport fishing	Public/SC WMRD					Important estuary; clams, oysters

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Pumpkinseed Is.	Estuarine Is.				Public/SCWMRD					Wading bird rookery (S,Su)
North Island	Estuarine Island	Yawkey Wild-life Center		Waterfowl hunting & wildlife pre-servation	Public/SCWMRD	800	13			Major wildlife area; waterfowl (S, W,F) hunting (F); S. bald eagle*, Am. Alligator (GAPC)
Cat Island	Estuarine Island	Yawkey Wildlife Center		Waterfowl hunting & wildlife pre-servation	Public/SCWMRD	2024				Major wildlife area, waterfowl (S, W,F) hunting (F); S. bald eagle*, Am. Alligator (GAPC)
South Island	Estuarine Island	Yawkey Wild-life Center		Waterfowl hunting & wildlife pre-servation	Public/SCWMRD	4400	2			Major wildlife area, waterfowl (S, W,F) hunting (F); S. bald eagle*, Am. Alligator (GAPC)
Santee River	River mouth			Sport fishing	Public/SCWMRD					
	River mouth	Santee Delta GMA		Waterfowl hunting	Public/SCWMRD	607		3	NA	Waterfowl (S,F,W) hunting (F); rec-ognized by IBP as a RNA (GAPC)
	River mouth	Santee Coastal Reserve GMA		Waterfowl hunting	Public/SCWMRD	10118	NA	NA		Loggerhead turtle (Su)*S.bald eagle* Am. Alligator; Major shorebird area (S,F,W) also a HPS.
	River mouth	N. Santee River POG		Shellfish mgt	Public/SCWMRD					Oysters
Cedar Island	Barrier Island			Recreation	Private/private		4			See Santee Coastal Reserve above
	River mouth	S. Santee River POG		Shellfish mgt.	Public/SCWMRD					Oysters
	River mouth	Francis Marion N.F.		Forestry	Public/USFS	100,932		21		Waterfowl (S, F, W) hunting (F) also GMA (GAPC)

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Charleston Co.										
Murphy Island	Barrier Island			Recreation	Private/private		7			See Santee Coastal Reserve above
	River mouth	Alligator Cr. SSA		Shellfish mgt.	Public/SCWMRD	0.7	NA			Oysters (GAPC)
Bull Bay	Bay, ocean			Fishing	Public/SCWMRD					Major shrimping area
		Cape Romain NWR		Fishing, boating, rail hunting	Public/USFWS	13852	32.2		12,120	Waterfowl hunting (F); major waterbird wintering area, especially black scoter, red know (a "blue list" species), bald eagle, peregrine falcon, oyster-catcher, nesting brown pelican (S,Su) & loggerhead turtle (Su); Am. alligator; also a NWA=11,736 ha
	Barrier Island	Bull Island		Fishing, boating, rail hunting	Public/USFWS		12	8		Isolated cultural/ethnic community; loggerhead turtle (Su), Am. alligator, brown pelican, major shorebird area (S,Su,F,W); see C. Romain NWR (NNL-UC)
	River mouth	Mathews Cut POG (Five Fathom Creek)		Shellfish mgt.	Public/SCWMRD	0.1				Oysters C.R.NWR, (GAPC)
			McClellanville	port	Private & public/private & public					Third most important fishing port in S.C.
	Barrier Island	Cape Island		Recreation	Private/private		4			see C.R. NWR
	Barrier Island	Lighthouse Is.		Recreation	Private/private		2			see C.R. NWR
	Barrier Island	Raccoon Key		Recreation	Private/private		4			

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
(Bull Bay continued)										
White Banks	Bay Island			Recreation	Private/private		NA			Wading bird rookery (S,Su)
Bird Island	Estuarine Island			Recreation	Private/private		NA			Wading bird rookery (S,Su)
Seewee Bay	Bay	Seewee Bay POG		Shellfish mgt	Public/SCWMRD	0.6	NA			Oysters (GAPC)
Prince Inlet	Estuarine Inlet			Sport fishing	Public/SCWMRD					Important estuarine system
Capers Island	Barrier Island	Capers Is. HPS		Natural Pre-servation	Public/SCWMRD and SCHPB		3			Loggerhead turtle (Su), S. bald eagle, Am. alligator, wading bird rookery
Dewees Island	Barrier Island			Recreation	Private/private		3			Intensive rec. beach (Su), Fishing pier (S,Su,F)
Isle of Palms	Barrier Island			Recreation	Private/private		10			Intensive rec. beach (Su), Major scaup (duck) wintering area
		Hamlin Cr. POG		Shellfish mgt	Public/SCWMRD		NA			Oysters (GAPC)
Sullivan Is.	Barrier Island			Recreation	Private/private		4			
		Conch Creek POG		Shellfish mgt	Public/SCWMRD	1.0	NA			Oysters
Charleston Harbor	River mouth		Charles, Mt. Pleasant	Seaport, fishing	Public/SCWMRD					Most important shrimping area in S.C. (Su); Major wintering water-bird area, canvas back (a "blue list" species), black scoter, ruddy duck, oystercatcher.
		Bearsford Cr. SSSSA		Shellfish mgt	Public/ SCWMRD					Oysters (GAPC)
		Wando Cr. SSSA		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)
		Fort Moutrie NM		Tourism	Public/SCPRT					
		Fort Sumpter NM		Tourism	Public/SCPRT					
Drum Island	Estuarine Island			Recreation	Private/private					
Ashley Island	Estuarine Island			Recreation	Private/private					Major wading bird rookery (S,Su)

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
(Ashley Is.)	River mouth	Ashley River SSR-UC		Boating	Public/SCPRT					
Morris Island	Barrier Is. River mouth			Recreation	Private/private	610	6			
		Folly Cr./ Lightninghouse Cr. POG		Shellfish mgt	Public/SCWMRD	63				Major Oyster area
Folly Island	Barrier Is. River mouth			Recreation	Private/private	567	10			Intensive rec. beach (Su)
		Folly River SSA		Shellfish mgt	Public/SCWMRD	0.9	NA			Oysters (GAPC)
		Cole Cr. SSA		Shellfish mgt	Public/SCWMRD	0.1	NA			Oysters (GAPC)
		Green Cr. SSA		Shellfish mgt	Public/SCWMRD	0.4	NA			Oysters (GAPC)
Johns Island	Estuarine Is			Residential	Private/private					Gullah on Island-Dependent on fishing, grass/reed collection for basketmaking
James Island	Estuarine Is			Residential	Private/private					Gullah on Island-Dependent on fishing, grass/reed collection for basketmaking
Wadmalaw Is.	Estuarine Is			Residential	Private/private					Gullah on Island-Dependent on fishing, grass/reed collection for basketmaking
Stone Inlet	River mouth			Sport fishing	Public/SCWMRD					Important estuary
Bird Key	Estuarine Is			Recreation	Private/private					
Kiawah Island	Barrier Is.			Recreation	Private/private	2844	13			Intensive recreation beach (Su)
		Kiawah Is. POG		Shellfish mgt	Public/SCWMRD	0.1				Oysters, wading bird rookery (S,Su) Brown pelican*, S. bald eagle* (W,S) (GAPC)
Seabrook Is.	Barrier Is.			Recreation	Private/private	2152	3			Intensive recreation beach (Su)

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCORPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
N. Edisto River Inlet	River Mouth			Sports fishing	Public/SCWMRD					Important estuary
		Leadenwah Cr. POG		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)
		Teogoodoo Cr. POG		Shellfish mgt	Public/SCWMRD	0.1				Oysters (GAPC)
Deueaux Bank	Barrier Island		Rockville	Recreation & P&CD	Private & public/Private & public					
Edisto Island	Barrier Island			Recreation & P&CD	Private & public/Private & public	5504	5			
		Edisto Beach SP		Tourism	Public/SCPRT	508	5		160	Intensive rec. beach (Su); also a NNL-UC; Fossil collecting on beach
			Edisto Beach	Recreation & P&CD	Private & public/Private & public	508	5			Intensive rec. beach (Su); sport fishing pier (S,Su,F)
S. Edisto River	River mouth			Sportsfishing	Public/SCWMRD					
Pine Island	Estuarine Is.			Recreation	Private/private	911	1		810	
Otter Island Beaufort Co.	Estuarine Is.			Recreation	Private/private	381	3		364	
St. Helena Sd.	River mouth			Fishing, boating	Public/SCWMRD					Major shrimping area
		Ashepoo River POG		Shellfish mgt	Public/SCWMRD	0.1				Oysters (GAPC)
	Estuarine Is.	Ash Is. POG		Shellfish mgt	Public/SCWMRD	2.0				Oysters (GAPC)
		Bear Is. GMA		Waterfowl hunting	Public/SCWMRD	3035		14		Waterfowl (S,F,W) hunting (F); Recognized by IBP as a RNA Also a NNL-UC (GAPC)
	River mouth	Lucie Pt. Cr. SSA		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)
		Old House Cr. SSSA		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)

OIL SENSITIVE AREAS OF THE SO. ATLANTIC SEASHORE

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Hunting Island	Barrier Is.			Recreation	Private/private	683	6			Intensive rec. beach (Su); boating
		Hunting Is.SP		Tourism	Public/SCPRT	2024	6	NA	1800	Intensive rec. beach (Su); boating; Nesting S. bald eagle (S,Su); wading bird rookery (S,Su); also a NNL-UC
Harbor Island	Barrier Is.			Recreation	Private/private					
Fripp Island	Barrier Island			Recreation	Private/private	727	4			
Pritchard Is.	Barrier Island			Recreation	Private/private	615	4			
Little Capers Is.	Barrier Island			Recreation	Private/private	324				
St. Phillips Is.	Barrier Island			Recreation	Private/private	2189	2			Wading bird rookery (S,Su) (NNL-UC)
Port Royal Sd.	River mouth			Sport fishing	Public/SCWMRD					
Beaufort River	River mouth			Sport fishing	Public/SCWMRD					
	Estuarine Is	Distant Is.SSA		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)
	River mouth	Chowan Cr.SSSA		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)
		Capers Cr.SSA		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)
			Port Royal Beaufort	Ports	Private & public/Private & public					Beaufort is 2nd most important fishing port in S.C.
Broad River	River mouth			Sport fishing	Public/SCWMRD					
		Whale Branch POG		Shellfish mgt	Public/SCWMRD	1.0				Oysters (GAPC)
		East Branch POG		Shellfish mgt	Public/SCWMRD	0.3				Oysters (GAPC)
		Euhaw Cr.SSA		Shellfish mgt	Public/SCWMRD	0.2				Oysters (GAPC)
		Habersh Cr./Chechesse Riv SSA-POG		Shellfish mgt	Public/SCWMRD	0.6				Oysters (GAPC)
		Marsh Is./Station Cr.POG		Shellfish mgt	Public/SCWMRD					(GAPC)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCORPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
(Broad Riv.)	Estuarine Is	Paris Island SSA		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)
Colleton Neck	Peninsula			Recreation	Private/private					
Colleton Riv.	River mouth			Boating, Sport fishing	Public/SCWMRD					
Bay Point	Barrier Is.			Recreation	Private/private	182	2			
Hilton Head Is.	Barrier Is.		Folly Field, Forest Beach, Sea Pines	Recreation and P&CD	Private & public/Private & public	11,275	18			Intensive rec. beach (Su); wading bird rookery (S,Su)
	River mouth	Last End Pt.POG		Shellfish mgt	Public/SCWMRD	0.1				Oysters (GAPC)
		Skull Cr. POG		Shellfish mgt	Public/SCWMRD					Oysters (GAPC)
Pinchney Is.	Barrier Is.	Pinchney Is. NWR		Waterfowl mgt	Public/USFWS	1621				Waterfowl (S,F,W), Brown Pelican
	River mouth	May Riv/Bull Cr. POG		Shellfish mgt.	Public/SCWMRD	3.9				Oysters (GAPC)
Daufuskie Is.	Barrier Is.			Recreation	Private/private	2501	3			
Jasper Co. Turtle Is.	Barrier Is.			Recreation	Private/private	706				
		Turtle Is.GMA		Waterfowl hunting	Public/SCWMRD					Waterfowl (S,F,W); hunting (F); general public use (S,Su,F); also a HPS
Oyster Bed Is.	Barrier Is.			Recreation	Private/private					
		Tybee NWR		Waterfowl mgt	Public/USFWS					
	River mouth	Savannah NWR		Waterfowl mgt	Public/USFWS	5331				Waterfowl hunting (F); S. bald eagle*, Am. alligator

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
GEORGIA										
Chatham Co.										
Tybee I.	Barrier I.		Savannah Beach	Tourism, recreation wildlife habitat	Public/U.S. NPS, FWS Private/Landowners	1640				Intensive use recreational beach (S,Su,F); tourist businesses; cultural features
		Tybee I. NWR		Tourism, wildlife habitat	Public/U.S. FWS	180	1	20	120	Shorebirds; bird rookery; includes Oyster Bed I.; sea turtle nesting sites
	Cockspur I.	Ft. Pulaski NM		Tourism	Public/US NPS	2273			2100	Cultural resources; tourist destination
Tybee Inlet	Creek mouth			Creek/marsh	Public/GA DNR		0.6			Wildlife transport to and from Tybee Creek
Little Tybee I.	Barrier I.			Wildlife habitat	Public/GA DNR Private/Landowners	2720	5.5	15	2472	Significant marsh habitat
Williamson I.	Barrier I.				Public/GA DNR	102.4	2.0		0	Evolving barrier island (20 yrs old)
Wassaw Sound	Bay/estuary			Nursery area, wildlife habitat	Public/GA DNR		4			
Wassaw I.	Barrier I.	Wassaw I. NWR		Wildlife habitat	Public/U.S. FWS	4025	9	15	3160	Important waterfowl, shorebird, and wading bird refuge; endangered alligator and brown pelican; beach use; breeding bird rookeries (S,Su); NNL (NPS)
Skidaway I.	Barrier I.			Wildlife habitat, tourism, housing	Public/GA DNR, Private/Landowners	8000				Wetlands and nursery areas; tourism, recreation, housing, and cultural resources; breeding bird rookeries (S,Su)
		Skidaway I.SP		Recreation, Tourism	Public/GA DNR	196	0	0	90	Marshes

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Ossabaw Sound	Bay/estuary			Nursery area	Public/GA DNR		7			Nursery area at mouth of Vernon and Ogeechee Rivers; navigation
Ogeechee River	River mouth		Richmond Hill	Coastal river habitat, tourism, recreation	Public/GA DNR Private/Landowners					SHS (Ft. McAllister, 14.8ha); RNA (multiple owners); RNA (IBP); NA (VMS); river study area under P.L. 95, sec. 5(a); waterfowl; recreation, cultural resources; water activities (canoeing, boating); recreational fishing
		Richmond Hill SP		Tourism, nursery area, recreation	Public/GA DNR	76	0	0	32	Cultural resources; recreation
		Richmond Hill HSS		Natural area	Public/GA DNR Private/Landowners	10462	0	80	8000	Waterfowl hunting
Ossabaw I.	Barrier I.			Nursery area, tourism	Public/GA DNR	8400	9.5	21	4920	Beach use (S,Su, F); cultural resources; breeding bird rookeries (S,Su); HSS (GHT); NRA (Ga. DNR)
Bryan Co. St. Catherines Sound	Bay/estuary			Wildlife habitat, navigation	Public/GA DNR		2.5			Nursery area;
Liberty Co. St. Catherines I.	Barrier I.			Recreation, exotic wildlife habitat, tourism	Private/E.J. Noble Fdn.	5776	17.6	16	3064	Rare and endangered species research archaeological research; cultural resources; recreation; beach use (S, Su, F); recreational fishing; breeding bird rookeries (S,Su); Cultural resources; NHS (private) Cultural resources (Ft. Morris)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
(Liberty Co.)		Sunbury SHS		Tourism	Public/GA DNR	80				Cultural resources (Ft. Morris)
McIntosh Co. Sapelo Sound	Bay/estuary			Nursery area, fish habitat	Public/GA DNR		4.3			Recreational fishing (shark, tarpon); wildlife habitat; HSS (private)
	Delta	Harris Neck NWR		Bird and shellfish habitat	Public/U.S. FWS	1075			1075	Wildlife habitat; salt marsh; endangered species (alligators, brown pelican); oyster beds; breeding bird rookeries (S,Su); feeding, resting, and wintering for migratory waterfowl;
Blackbeard I.	Barrier I.	Blackbeard I. NWR		Wildlife habitat	Public/U.S. FWS	2247	14.4	3	1800	NA(UC); RNA(FCER); NA(SAF) 180 ha.; endangered species (sea turtles, bald eagles, alligators, brown pelicans); important wildlife habitat; waterfowl and aquatic bird hunting; fishing; wildlife appreciation; breeding bird rookeries (S,Su); NWA (1200 ha);
Sapelo I.	Barrier I.			Wildlife research; public education	Public / Private GA G&F	6500	9	26	1500	HSS(GHT); two RNA (IBP); NA(SAF) saltmarsh community; endangered species (alligator, pelican, bald eagle & 9 other species); floodplain forest; hunting, beach use(s); fishing; birding; breeding bird rookeries (S,Su);
		Sapelo I. WMA R.J. Reynolds SWR		Wildlife habitat	Public/GA G&F	7200	5	13	2500	Includes Cabretta I.; Waterfowl and marsh hen hunting (F,W); Limited beach use(s)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
(McIntosh Co.)										
		Sapelo I. National Estuarine Sanctuary		Research & Education	Public/GA G&F	2460			1500	Duplin River Estuary
		Sapelo I. NA		Wildlife Pre-servation	Public/GA DNR	28	0	0	0	Nature appreciation; limited beach use(s)
		Hog Hammock		Community life	Private/ Foundation	162	0	0	0	Ethnic-cultural integrity
Doboy Sound	Bay/estuary	None		Fisheries habitat; Boating Fairway	Public/GA DNR		2.8			Shrimp; finfish nursery; commercial and recreational fishing
Wolf I. and Egg I.	Barrier I.	Wolf I. NWR		Wildlife habitat, salt marsh	Public/U.S. FWS	2050	6	8	1952	NWA (2050 ha); extensive salt marsh and adjacent mud flats; fish and shellfish nursery area; endangered species (pelicans); shorebird and waterfowl refuge; Migratory bird refuge (waterfowl); loggerhead tur-tle nesting sites; salt marshes
Altamaha Sound	Bay/estuary			Wildlife habitat	Public/GA DNR		3.8			Fish and shellfish habitat
Altamaha River	River			Wildlife habitat	Public/GA DNR Private/Land-owner					Hofwyl Broadfield SHS (GaIWR,507ha); Lewis I. HAA (Ga. DNR,2253 ha); RNA (IBP); PHA(Brunswick Pulp and Paper Co.); wild and scenic river; HSS (Ga.IWR); cultural resources; re-creation, hunting; tourism; River Area (TNC); breeding bird rookeries (S,Su)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
(McIntosh Co.)		Altamaha R. WMA		Wildlife management	Public/GA DNR	8800	0		2400	Endangered species (manatee, alligator, bald eagle); waterfowl hunting; educational tours; recreational fishing
Glynn Co.										
Little St. Simons I.	Barrier I.			Recreation, farming	Private/Land-owners	3600	10	20	2616	Vacation retreat for Stockton Lumber Company
Sea I.	Barrier I.			Residential development	Private/Land-owners	800	7	5	320	Primary tourist destination
St. Simons I.	Barrier I.		St. Simons	Residential development	Public/U.S. NPS Private/Land-owners	11052	5	40	6152	Recreation; tourism, cultural resources; salt marshes
		Ft. Frederica NM		Tourism and recreation	Public/U.S. NPS	87				Cultural resources
St. Simons Sound	Bay/estuary			Nursery area, recreation	Public/GA DNR		2.2			Fish and shellfish habitat
Jekyll I.	Barrier I.	Jekyll I. Authority State Resort		Tourism, recreation	Private/Jekyll I. State Park Authority	2400	13		560	Recreation; tourism; residential area; beach use (S,Su,F)
Camden Co.										
St. Andrews Sound	Bay/estuary		None	Nursery area wildlife habitat	Public/GA DNR		4.3			
Satilla R.	River			Recreation, wildlife habitat	Public/GA DNR and private					NNL-UC; Satilla Scenic River-UC; Major recreation area (fishing, boating, canoeing); 2 RNA (IBP); breeding bird rookeries (S,Su)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
(Camden Co.)										
Little Cumberland I.	Barrier I.		None		Private but in NPS jurisdiction	960	4		316	
Cumberland I.	Barrier I.	Cumberland I. NS	None	Recreation, wildlife habitat, tourism, nature studies	Public/U.S. NPS	14751	2.8	38		NWA (14751 ha.); crooked r. sp(200 ha); salt marsh, beach; recreation (S,Su,F); breeding bird rookeries (S,Su)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
FLORIDA										
Nassau Co.										
St. Marys R.	Bay-estuary		St. Marys	Fisheries and Wildlife Habitat, Boating Fairway	Public/GA. and FL. DNR		1.3			Manatee CH; Endangered Species (manatee, sea turtles); shrimp and hibernacula habitat; recreational fishing
Amelia I.	Barrier I		Fernandina Beach, Amelia City, Franklintown	Recreation	Public/FL. DNR	6440	18	33		NHS (FL.) sea turtles; beach use(s); primary tourist destination; cultural features
		Ft. Clinch SP/ AP		Tourism and Wildlife Habitat	Public/FL. DNR DRM and DRP	434	1.1	3.2		Intensive use recreational beach; aesthetic and cultural resources
		Fernandina Beach RA		Recreation	Public/FL. DNR DRP					Primary tourist destination area; recreational fishing
Duval Co.										
Nassau Sound	Bay-estuary	Nassau & St. Johns R. AP		Fisheries and Wildlife Habitat	Public/FL. DNR DRP		4.3			Sea turtles; salt marsh community
Bird Island	Barrier I.	Bird Island NNL (D)		Community Life and Wildlife Habitat	Public/ FL. DNR and Private/landowner	40	1	1.5		Pioneer plant communities; endangered species (pelican); bird nesting and resting area

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
Little Talbot I.	Barrier I.			Habitat and Tourism	Public/FL.DNR		6.4	5		NNL(D) - 207 ha; Recreational use(s); endangered species (sea turtles, manatee, alligators, ospreys, pelicans); salt marsh community; nesting area for endangered loggerhead turtle; Undisturbed plant communities; loggerhead turtle nesting area
		Little Talbot I SP		Recreation	Public/FL.DNR DRP	1000				Primary recreation use destination
		Pablo Creek EEL (P)		Wildlife Habitat	Public/FL. DNR DRP	~1000				Endangered species (manatee, alligator, osprey, pelican); Salt marsh community
Big Talbot I.	Barrier I.			Wildlife Habitat	Public/FL.DNR		0	4.3		
		Big Talbot & Long I. EEL (P)		Wildlife Habitat	Public/FL. DNR DRP					
St. Johns R.	River-bay-estuary and shoreline		Jacksonville	Wildlife Habitat and Recreation			0.6			Manatee (CH); Ft. Carolina NHS; Yellow Bluff SHS (57.7 ha); Fisheries habitat (American shad, blueback herring, shrimp, sturgeon, eels)
		Ft. Caroline NM		Recreation	Public/U.S. NPS	51.4	0	0.2	0	Cultural resources; primary tourist destination; breeding bird rookeries (S,Su)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
St. Johns R. (cont.)		Nassau and St. Johns R. EEL		Watershed Area	Public/FL. DNR DRP	~1500				Major freshwater source; includes Big and Little Talbot Islands
St. Johns Point & South Duval Co. Coast	Barrier Beach		East Mayport, Manhattan Beach, Atlantic Beach	Recreation and Wildlife Habitat	Public/FL. DNR and Private/landowners		8.2	0	0	Palm Valley NNL(D) - about 2000 ha; Sea turtle and white shrimp habitat; primary recreation destination
St. Johns Co.										
North St. Johns Co. Coast (to Anastasia I)	Barrier Beach		Neptune Beach, Jacksonville Beach, Ponte Verde Beach, Usina Beach, Vilano Beach, St. Augustine		Public/FL. DNR and Private/landowners		48	0		Sea turtle and white shrimp habitat; primary recreation destination
		Guana R. WMA		Wildlife Habitat	Public/FL. DNR GFWFC and Private/landowners					Wildlife management
		Castillo de San Marcos NM		Tourism	Public/U.S. NPS	7.9	0	0	0	Cultural features; primary tourist destination
St. Augustine Inlet	Barrier I. Break			Fisheries Habitat	Public/FL. DNR		1			Larval transport to and from nursery areas
Conch Island	Barrier I.						5	7		
Anastasia I.	Barrier I.		St. Augustine Beach, Butler Beach, Crescent Beach, Summer Haven	Recreation	Public/FL. DNR and Private/landowners	4080	19	32		Primary recreation destination; habitat for white shrimp and sea turtles

PRIMARY COASTAL IMPACT AREA	MAJOR LANDFORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
Anastasia I. (cont.)										
		Anastasia SRA		Recreation	Public/FL. DNR DRP	414	4	7	80	Primary recreation destination
		Frank B. Butler SRA		Recreation	Public/FL. DNR DRP	21.2	0.3			Primary recreation destination; habitat for whiteshrimp
		Faver Dykes SP		Recreation	Public/FL. DNR DRP	301		0.7		Primary recreation destination
		Pellicer Creek AP		Wildlife Habitat and Recreation	Public/FL. DRN DRM					Recreation use; adjacent to Faver Dykes SP
Mantanzas Inlet	Barrier I. Break			Fisheries Habitat and Recreation	Public/FL. DNR		0.3			Larval transport to and from nursery areas
Flagler Co. Matanzas I.	Barrier I.		Summer Haven, Marineland	Wildlife Habitat and Recreation	Public/FL. DNR and Private/landowners	1680	17			Ft. Matanzas SHS; Includes only section of natural rocky coast between Capes Hatteras & Canaveral; sea turtles; primary recreation destination
	Ft. Mantanzas NM	Ft. Matanzas NM		Tourism	Public/U.S. NPS					Primary tourist destination
		Marineland South EEL (P)		Wildlife and Fisheries Habitat; Education; Research	Public/FL. DNR DRP	34	3	0	0	Unique cocina formations on beach; oceanarium
		Washington Oaks Ornamental Gardens SP		Recreation and Tourism	Public/FL. DNR DRP	136	0.4	2.3		Primary tourist and recreational destination (year-round)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Cocoa I.	Barrier I		Cocoa Beach, S. Patrick Shores, Satellite Beach, Indian Harbor Beach, Canova Beach, India-lantic, Melbourne Shores, Floridana Beach, Sebastian	Recreation and Wildlife Habitat	Public/FL. DNR and Pri-vate/land-owners	8640	70			Sea turtle habitat; recreation; beach use(s) (year-round)
		Sebastian Inlet SRA		Recreation	Public/FL. DNR DRP	231.3	4.5	16.1		Primary recreation destination

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Flagler & Volusia Co.										
Flagler I.	Barrier I.		Flagler Beach, Ormond-by-the-Sea, Ellinor Beach, Holly Hill, Daytona Beach, Halifax Estates, Port Orange, Wilbur-by-the-Sea, Ponce Inlet	Wildlife Habitat, Recreation, Tourism	Public/FL. DNR and Private/land-owners	4760	85	100		Sea turtles; invertebrate and fish habitat; recreation; recreation and commercial fishing (year-round); beach use(s) (year-round)
		Flagler Beach SRA		Recreation	Public/FL. DNR DRP	58	0.7	2.4		Primary recreation destination (year-round)
		Tomoka Marsh AP		Wildlife Habitat and Recreation	Public/FL. DNR DRM					Fish and Invertebrate (white shrimp) habitat and nursery; salt marsh community; recreation; adjacent to Tomoka SP
		Tomoka SP		Recreation	Public/FL. DNR DRP	365.8		10		Primary recreation destination
Ponce de Leon Inlet	Barrier I. Break		Ponce Inlet	Wildlife Habitat and Recreation	Public/FL. DNR		0.5			Larval transport to and from nursery areas
Volusia & Brevard Co.										
Mosquito I	Barrier I.		New Smyrna Beach, Edgewater, Hucomer, Turtle Mound, Eldora, Oak Hill, Shiloh	Wildlife Habitat and Recreation	Public/FL. DNR and Private/land-owner	6120	65			Turtle Mound SHS; Fish and invertebrate habitat; sea turtles; Primary recreation destination; beach use(s) (year-round); breeding bird rookeries (S,Su)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSIFICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS				SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
						Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	
Mosquito I. (cont.)										
		Bloom Tract EEL (P)		Wildlife Habitat	Public/FL. DNR DRP	10.8	0.85	0	0	Typical Florida vegetation; near Turtle Mound SHS; recreation
		Turtle Mound SP		Recreation	Public/FL. DNR DRP	4	0.2	0.25		Sea turtles; beach use(s); recreation; cultural features
Mosquito Lagoon	Coastal Lagoon		New Smyrna Beach, Edgewater, Hucomer, Shiloh	Wildlife Habitat	Public/FL. DNR and U.S. FWS and NASA		0	~200		Significant fish and wildlife habitat; major nursery area; juvenile sea turtles; bird habitat
		Mosquito Lagoon AP		Wildlife Habitat	Public/FL. DNR DRM					
Merritt I.	Barrier I.		Wilson, Orsino, Courtenay, Merritt Island	Wildlife Habitat, Tourism, and Recreation	Public/FL. DNR and U.S. FWS and NASA		0	~200		Critical habitat (seaside sparrow); Major wildlife habitat; endangered species (southern bald eagle, brown pelican, peregrine falcon, dusky seaside sparrow, Florida manatee, alligator); waterfowl hunting; recreational fishing
		Merritt I. NWR		Fish and Wildlife Habitat	Public/U.S. FWS	55722	0	~100	13600	Migratory bird refuge (waterfowl); archaeological sites
Indian River	River and Marsh		Titusville, Indian River City, Delespine, Fontenac, City Point, Cocoa, Merritt Island, Melbourne, Indialantic, Palm Bay, Roseland, Sebastian and more	Fisheries and Wildlife Habitat; Recreation	Public/U.S. FWS and NMFS and FL. DNR		0			Critical habitat (manatee); Significant nursery area for fisheries; waterfowl habitat; major oyster grounds; recreational fishing; beach use(s); recreational activities; breeding bird rookeries (S,Su)

PRIMARY COASTAL IMPACT AREA	MAJOR LAND-FORM CLASSI-FICATION	SPECIAL MANAGEMENT UNITS	INCOPORATED TOWNS	MAJOR LAND USE	OWNERSHIP & MANAGEMENT RESPONSIBILITY	TIDALLY AFFECTED AREAS Total Hectares	Ocean Shore (KM)	Bay Shore (KM)	Marsh (HA)	SPECIAL DESIGNATIONS SENSITIVE FEATURES PRINCIPAL USES
Indian River (cont.)										
		Indian River AP		Wildlife Habitat	Public/FL. DNR DRM					Waterfowl and oysters
Canaveral I.	Barrier I.		Titusville Beach, Cape Canaveral	Recreation	Public/FL. DNR and Private land-owners	7760	30			Major wildlife habitat; endangered species (manatee, dusky seaside sparrow, pelican, bald eagle, peregrine falcon, hawksbill turtle, leatherback turtle, loggerhead turtle); sensitive lagoons; commercial and recreational fishing (year-round); waterfowl hunting (F,W); recreation
		Cape Canaveral NS		Recreation and Wild-life Habitat	Public/U.S. NPS, FWS, and NASA	23051	~40	~140		Primary recreation destination
Banana River	River and Marsh		Cocoa Beach, S. Patrick Shores, Satellite Beach, Indian Harbor Beach, Lofils, Merritt Island	Wildlife Habitat	Public/FL. DNR					Major fishery and wildlife habitat; endangered species (pelican, roseate spoon bill, wood ibis, black-whiskered vireo, and east coast marsh snake); mangroves, spotted seatrout and migratory waterfowl habitat; nursery area; juvenile sea turtles
		Banana River AP		Wildlife Habitat	Public/FL. DNR DRM		0			Major nursery area for fisheries
		Thousand Is-lands EEL (P)		Wildlife Habitat	Public/FL. DNR DRP	1200	0			

APPENDIX D

OIL SPILL RISK ANALYSIS

APPENDIX D

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AN OILSPILL RISK ANALYSIS FOR THE SOUTH ATLANTIC
(PROPOSED SALE 56)
OUTER CONTINENTAL SHELF LEASE AREA

By William B. Samuels and Kenneth J. Lanfear

U. S. GEOLOGICAL SURVEY

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AN OILSPILL RISK ANALYSIS FOR THE SOUTH ATLANTIC
(PROPOSED SALE 56)
OUTER CONTINENTAL SHELF LEASE AREA

By William B. Samuels and Kenneth J. Lanfear

Abstract

An oilspill risk analysis was conducted to determine the relative environmental hazards of developing oil in different regions of the South Atlantic Outer Continental Shelf (OCS) lease area. The study analyzed the probability of spill occurrences, likely paths of oil slicks, and locations of resources vulnerable to spilled oil. The analysis included estimates of the time between spill occurrence and contact with resources. The combined results yielded estimates of the overall risks associated with development of the proposed lease area. Assuming that oil will be found in all parts of the lease area, and depending upon the routes chosen to transport oil from OCS platforms to the shore, the leasing of the tracts proposed for OCS Sale 56 will, depending upon how oil is transported to shore, result in an expected 3.0 spills. The estimated probability that land will be contacted by one or more oilspills which have been at sea less than 30 days is 0.50.

Introduction

The Federal Government has proposed to offer Outer Continental Shelf (OCS) lands off the South Atlantic coast for oil and gas leasing. The risked mean estimate of oil resources for the proposed 286 tracts is 493 million barrels of crude oil. Contingent upon actual discovery of this quantity of oil, production is expected to span a period of 30 years. There are 43 existing Federal lease tracts in the study area, containing an estimated 7.9 million barrels of crude oil (risked mean estimate).

Oilspills are one of the major concerns associated with offshore oil production. An important fact that stands out when one attempts to evaluate the significance of accidental oil spillage is that the problem is fundamentally probabilistic. Uncertainty exists about the amount of oil that will be produced from the leases and the number and size of spills that might occur during the life of production, as well as the wind and current conditions that would exist at the time of a spill occurrence and give direction to the oil slick. While some of the uncertainty reflects incomplete and imperfect data, considerable uncertainty is simply inherent in the problem of describing future events over which complete control cannot be exercised. Since it can not be predicted with certainty that a probabilistic event such as an oilspill will occur, only the likelihood of occurrence can be quantified. It is important to consider the range of possible effects that could accompany a

decision on oil and gas production. It is equally important, in attempting to maintain perspective on the problem, to associate each potential effect with a quantitative estimate of its probability of occurrence.

This report summarizes results of an oilspill risk analysis conducted for the proposed South Atlantic OCS Lease Sale 56. The study had the objective of determining relative risks associated with oil and gas production in different regions of the proposed lease area. It was undertaken for consideration in the draft environmental impact statement (EIS), and to facilitate final selection of tracts to be offered for sale. A description of the oilspill trajectory analysis model can be found in a previous paper (Lanfear and others, 1979). The analysis was conducted in three parts corresponding to different aspects of the overall problem. The first part dealt with the probability of oilspill occurrence, and the second with the trajectories of oilspills from potential launch points to various targets. Results of the first two parts of the analysis were then combined to give estimates of the overall oilspill risk associated with oil and gas production in the lease area.

Decisionmaking Under Risk and Uncertainty

Oilspill impacts result primarily from two events which are probabilistic in nature: oilspill occurrence due to accidents, and oilspill movement by random winds and currents. While it can not be said with certainty that a probabilistic event, such as an oilspill will or will not occur, the likelihood of occurrence can be quantified. It is possible to predict the likelihood that oilspills will result from an OCS leasing decision, but whether they will actually occur can only be known after the area is explored and the oil, if any, is produced. This is in contrast to a deterministic situation where a particular action can be depended upon to produce a specific result.

In making decisions under risk and uncertainty, it is important to understand that a choice can have a range of possible outcomes. Generally, a desire to maximize the likelihood of the most favorable outcomes must be tempered by the need to minimize the probability of highly unfavorable outcomes. The USGS Oilspill Trajectory Analysis (OSTA) Model was designed to reflect the range of possible outcomes of leasing decisions by estimating the probability of occurrence for each discrete outcome; specifically, it estimates the likelihood that a target will be contacted by 0, 1, 2, ..., N oilspills during the production life of an OCS lease area.

The probability that, if an oilspill occurs at a given launch point, it will contact a particular target is termed a conditional probability. Such conditional probabilities can be very useful in identifying those launch points at which an oilspill, if it occurs, poses the highest risks to various targets. Tables of conditional probabilities can help the analyst to select alternatives that will reduce overall risk. However, conditional probabilities do not include the probability of oilspill occurrence. A tract that contains little or no oil is a small risk because, no matter how high the conditional probability of contacting a target may be, the small amount of oil makes it unlikely that an oilspill will occur. Also conditional probabilities for spills originating at the production platforms do not necessarily reflect the risks of transportation. For these reasons, analysts are cautioned against basing judgments solely upon conditional probabilities.

Summary of the Proposed Action and the Major Alternatives

The proposed action is to lease 286 tracts on the outer continental shelf off the South Atlantic coast. The study area for this analysis includes all of these tracts and extends from latitude 28 degrees N to 37 degrees N, and from longitude 73 degrees W to 81 degrees 40 minutes W. The study area is shown as a Mercator projection in Figure 1.

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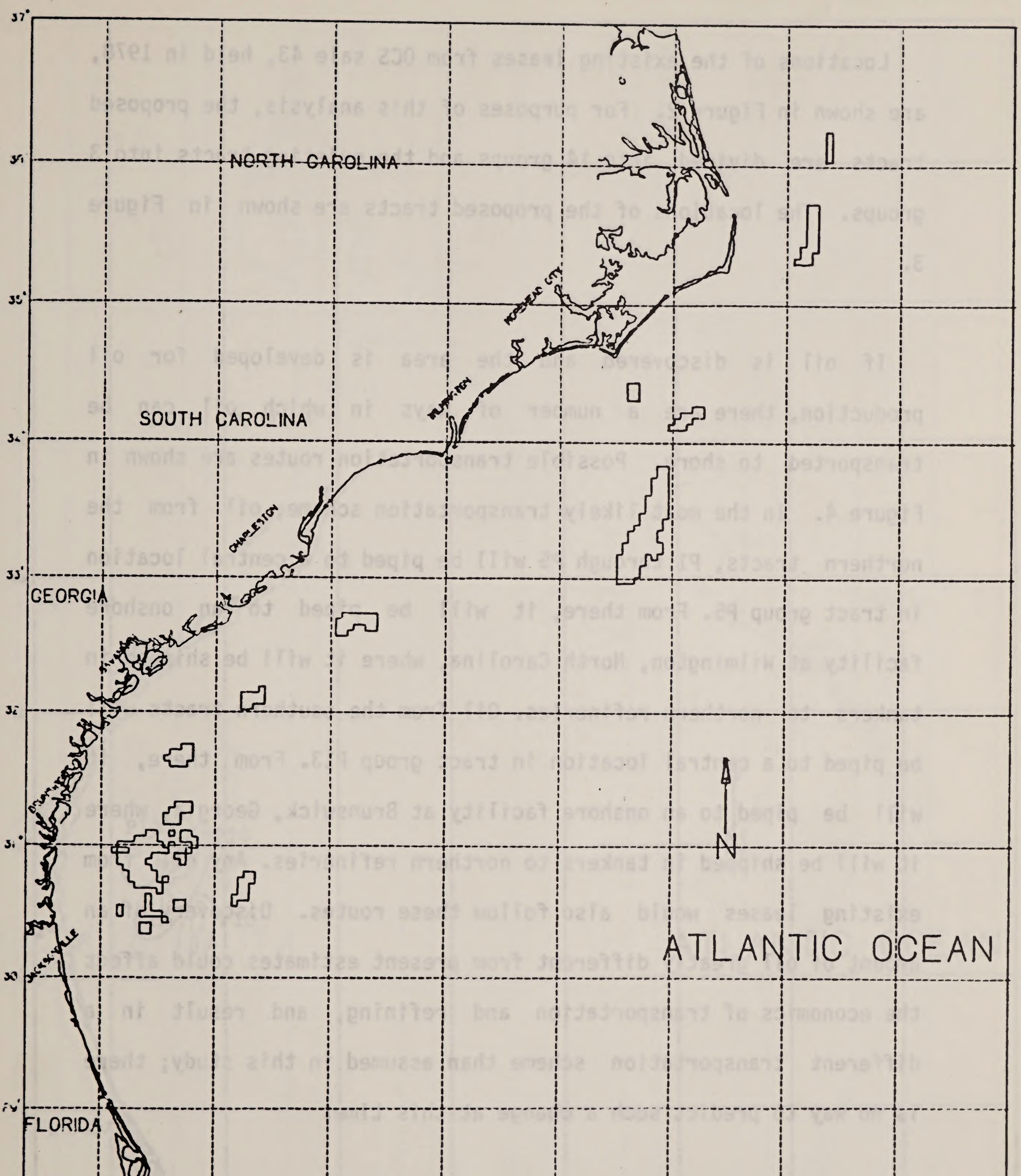

Figure 1.--Map showing the South Atlantic OCS Lease Sale 56 study area and the proposed lease tracts.

Locations of the existing leases from OCS sale 43, held in 1978, are shown in Figure 2. For purposes of this analysis, the proposed tracts are divided into 14 groups and the existing tracts into 3 groups. The locations of the proposed tracts are shown in Figure 3.

If oil is discovered and the area is developed for oil production, there are a number of ways in which oil can be transported to shore. Possible transportation routes are shown in Figure 4. In the most likely transportation scheme, oil from the northern tracts, P1 through P5 will be piped to a central location in tract group P5. From there, it will be piped to an onshore facility at Wilmington, North Carolina, where it will be shipped in tankers to northern refineries. Oil from the southern tracts will be piped to a central location in tract group P13. From there, it will be piped to an onshore facility at Brunswick, Georgia, where it will be shipped in tankers to northern refineries. Any oil from existing leases would also follow these routes. Discovery of an amount of oil greatly different from present estimates could affect the economics of transportation and refining, and result in a different transportation scheme than assumed in this study; there is no way to predict such a change at this time.

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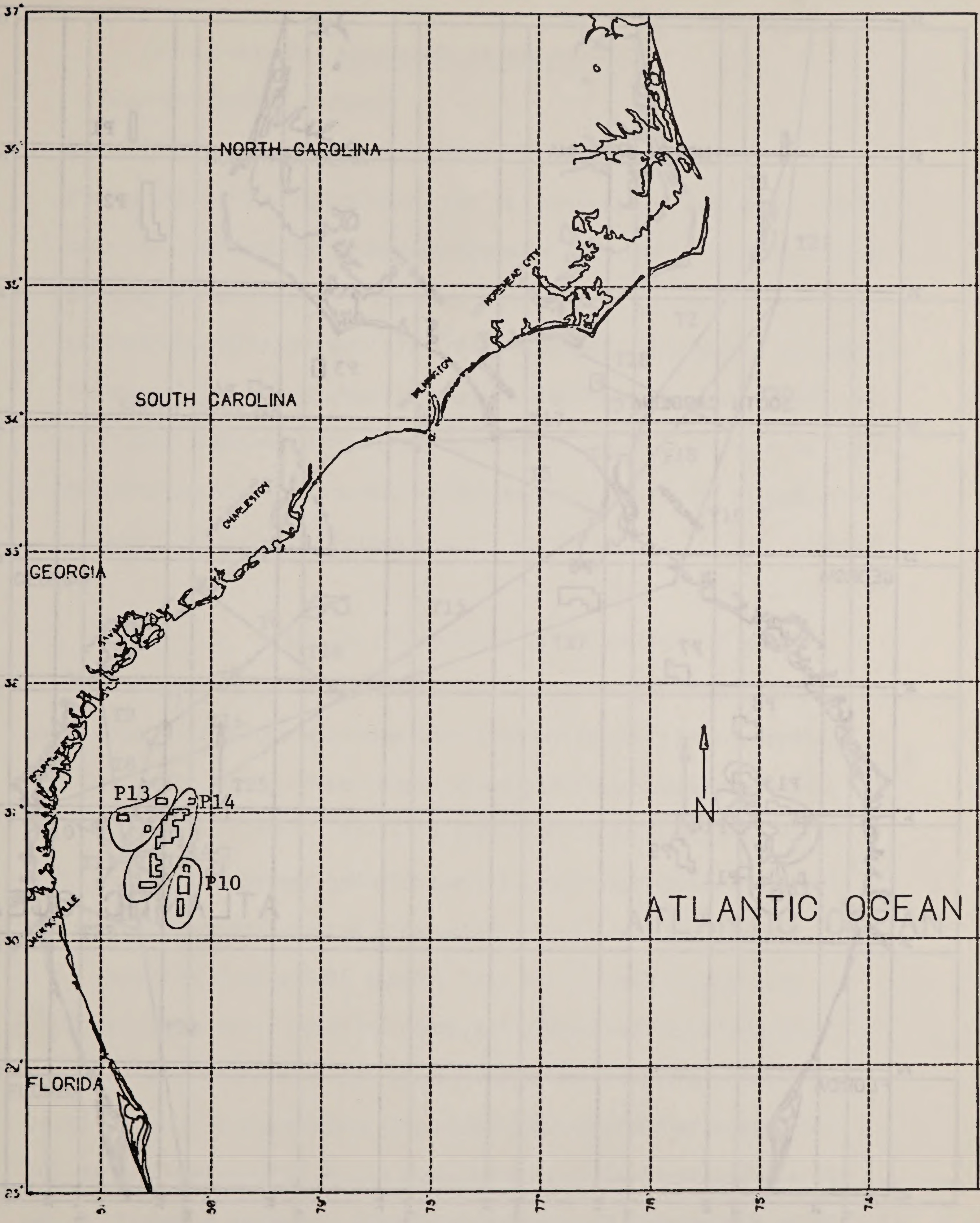

Figure 2.--Map showing the subdivisions of the existing leases in the study area.

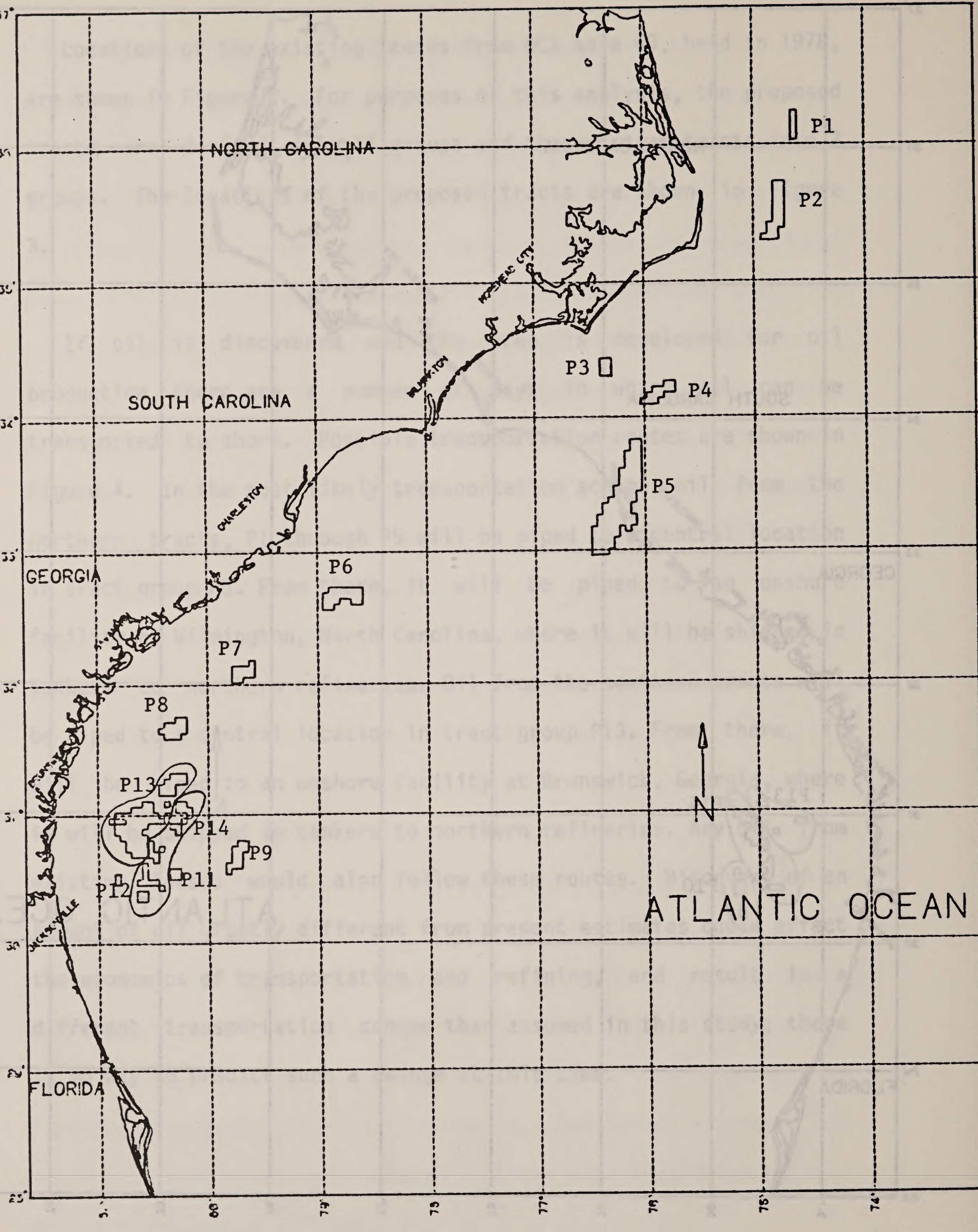

Figure 3.--Map showing the subdivisions of the proposed leases for South Atlantic OCS Lease Sale 56.

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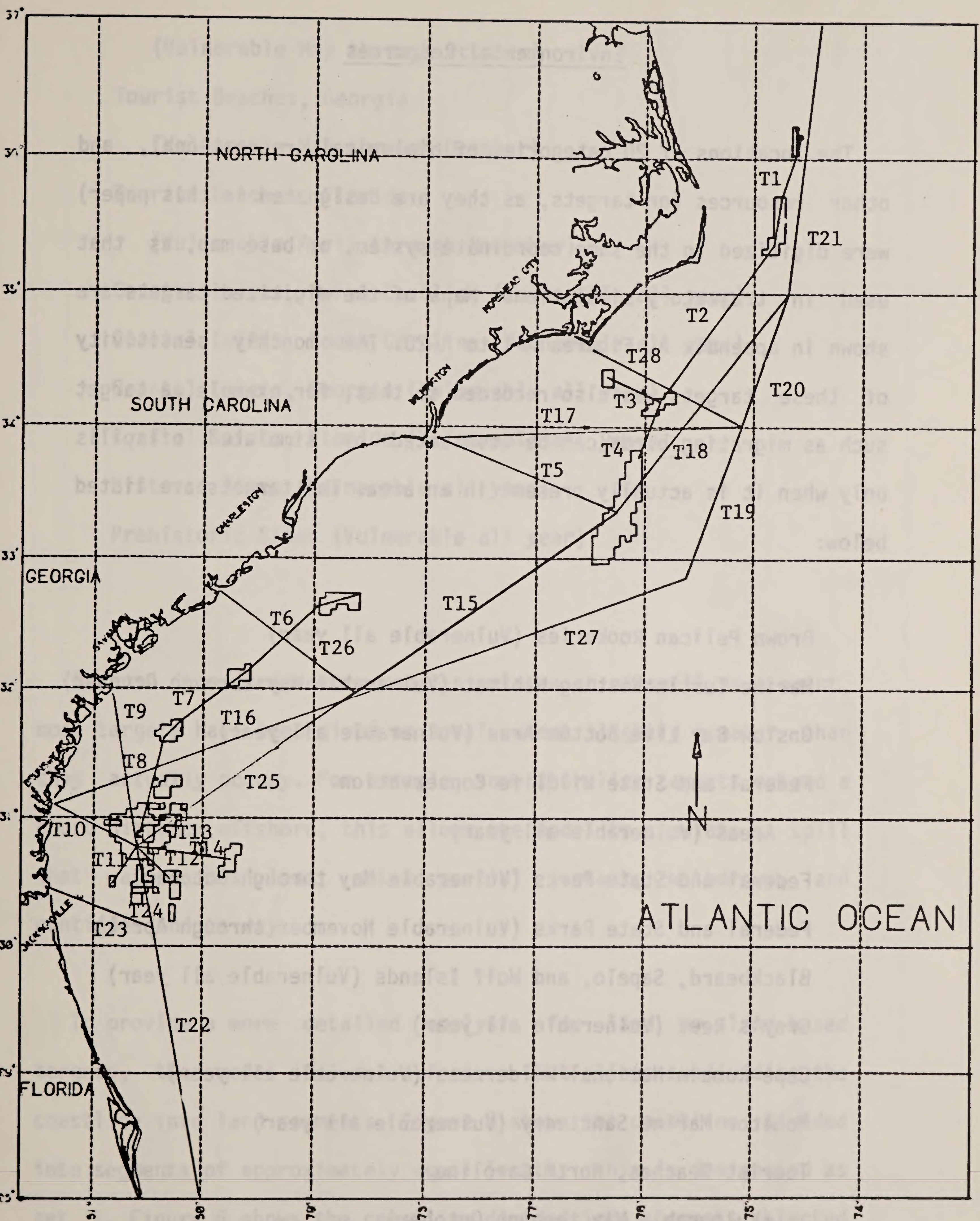

Figure 4.--Map showing the transportation route segments (T1-T28); polygons represent proposed and existing lease tracts.

Environmental Resources

The locations of 20 categories of biological, recreational, and other resources (or targets, as they are designated in this paper) were digitized in the same coordinate system, or base map, as that used in trajectory simulations. Maps of the digitized targets are shown in appendix A, Figures A-1 to A-20. The monthly sensitivity of these targets was also recorded so that, for example, a target such as migrating birds can be contacted by simulated oilspills only when it is actually present in an area. The targets are listed below:

Brown Pelican Rookeries (Vulnerable all year)
Marine Turtle Nesting Habitat (Vulnerable May through October)
Onslow Bay Live Bottom Area (Vulnerable all year)
Federal and State Wildlife Conservation
  Areas (Vulnerable all year)
Federal and State Parks (Vulnerable May through October)
Federal and State Parks (Vulnerable November through April)
Blackbeard, Sapelo, and Wolf Islands (Vulnerable all year)
Gray's Reef (Vulnerable all year)
Cape Romain National Wilderness (Vulnerable all year)
Monitor Marine Sanctuary (Vulnerable all year)
Tourist Beaches, North Carolina
  (Vulnerable May through October)
Tourist Beaches, South Carolina

(Vulnerable May through October)

Tourist Beaches, Georgia

(Vulnerable May through October)

Tourist Beaches, Florida

(Vulnerable April through November)

Coastal Inlets, North Carolina (Vulnerable all year)

Coastal Inlets, South Carolina (Vulnerable all year)

Coastal Inlets, Georgia (Vulnerable all year)

Coastal Inlets, Florida (Vulnerable all year)

Historic Sites (Vulnerable all year)

Prehistoric Sites (Vulnerable all year)

Because the trajectory model simulates an oilspill as a point, most targets have been given an areal extent slightly greater than they actually occupy. For example, some shoreline targets extend a short distance offshore; this allows the model to simulate a spill that approaches land, makes partial contact, withdraws, and continues on its way.

To provide a more detailed analysis for land or land-based targets, the model includes a feature that allows subdividing the coastline into land segments. Figure 5 shows the coastline divided into segments of approximately equal length; this is designated as set 1. Figure 6 shows the coastline divided into segments selected by BLM analysts; this is designated as set 2.

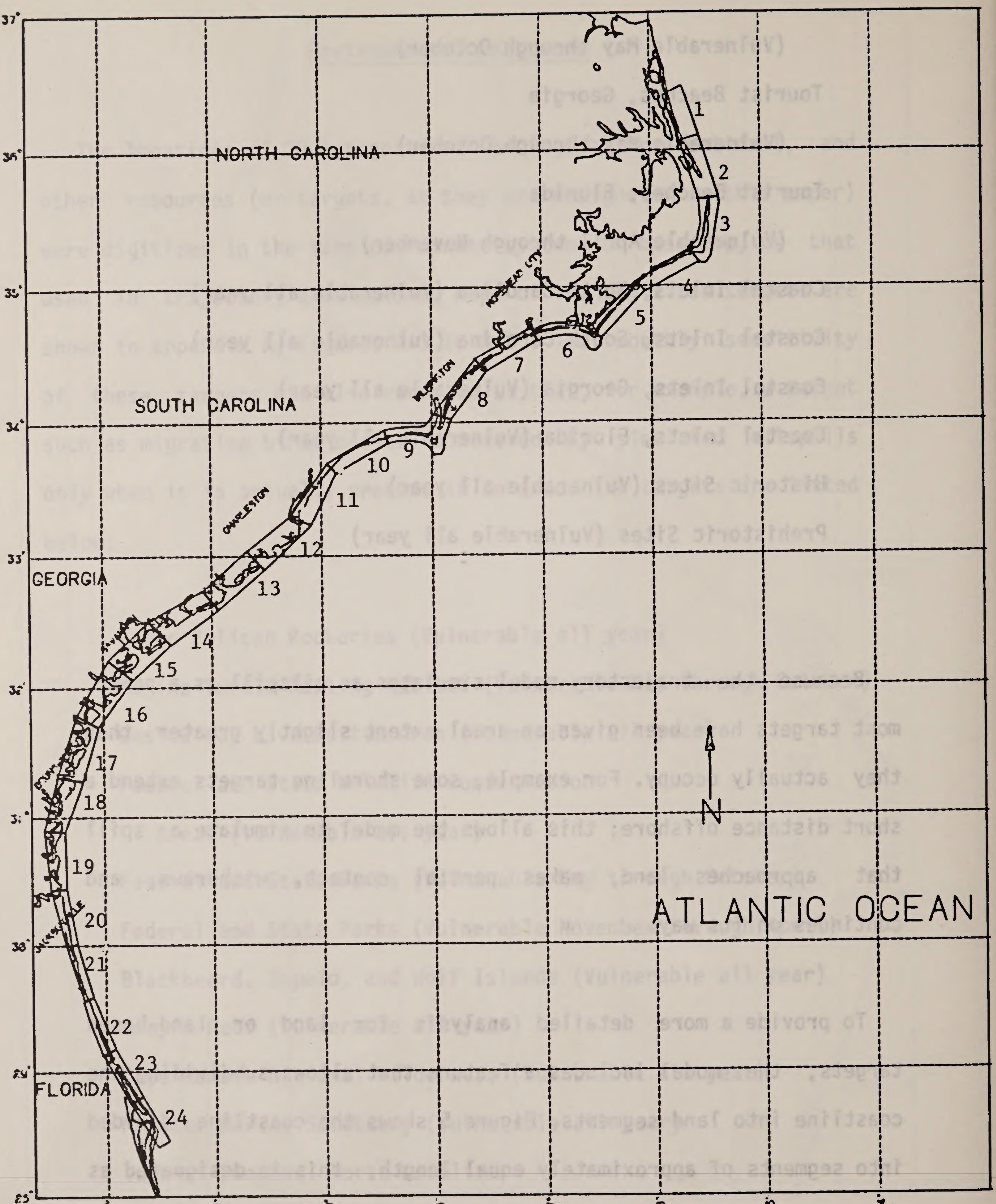

Figure 5.--Map showing the division of the South Atlantic shoreline into segments of approximately equal length (set 1).

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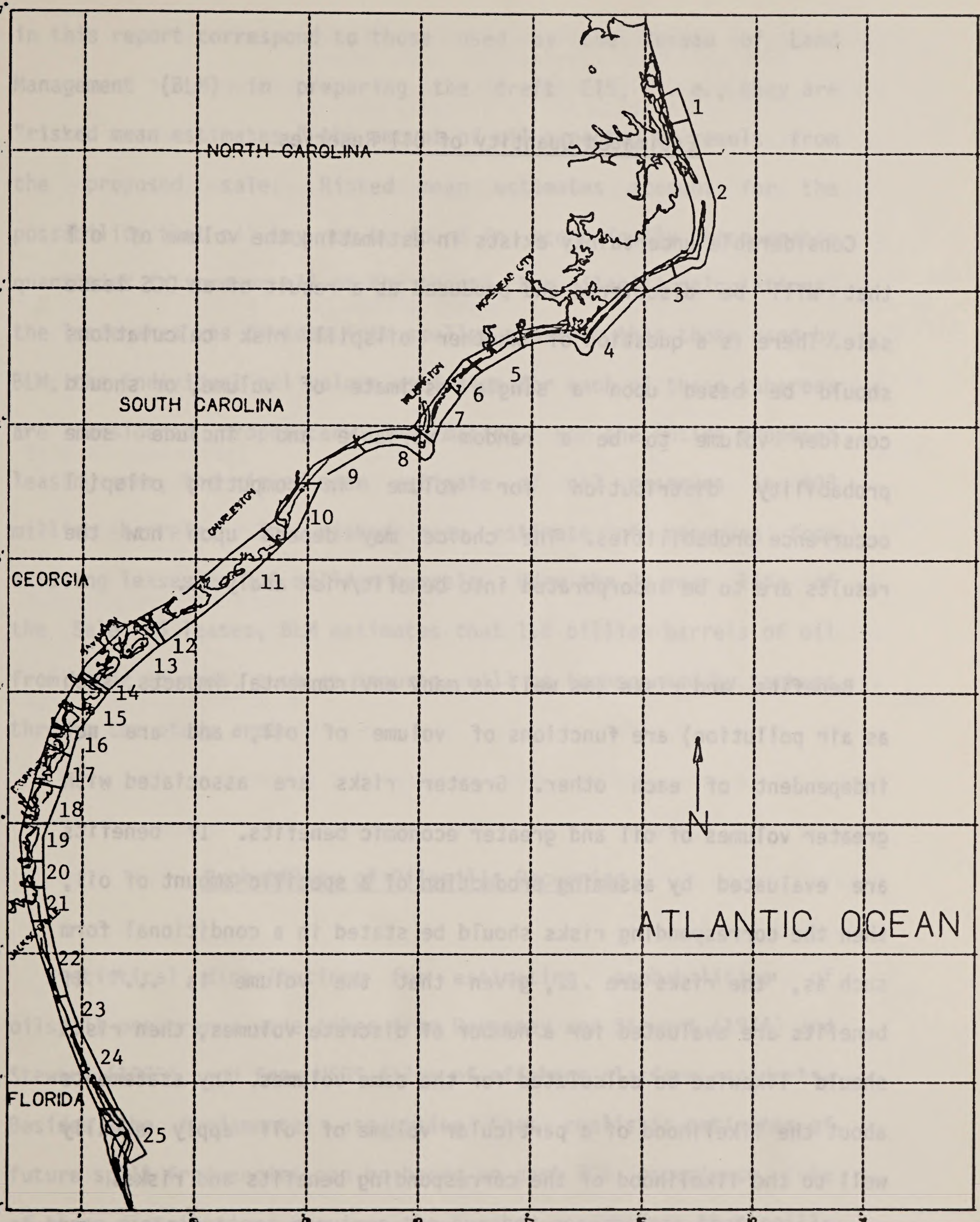

Figure 6.--Map showing the division of the South Atlantic shoreline into segments selected by BLM (set 2).

Estimated Quantity of Oil Reserves

Considerable uncertainty exists in estimating the volume of oil that will be discovered and produced as a result of an OCS lease sale. There is a question of whether oilspill risk calculations should be based upon a single estimate of volume, or should consider volume to be a random variable and include some probability distribution for volume in computing oilspill occurrence probabilities. The choice may depend upon how the results are to be incorporated into benefit/risk analysis.

Benefits and risks (as well as many environmental impacts, such as air pollution) are functions of volume of oil, and are not independent of each other. Greater risks are associated with greater volumes of oil and greater economic benefits. If benefits are evaluated by assuming production of a specific amount of oil, then the corresponding risks should be stated in a conditional form such as, "the risks are ..., given that the volume is ..." If benefits are evaluated for a number of discrete volumes, then risks should likewise be calculated for the same volumes. Any statements about the likelihood of a particular volume of oil apply equally well to the likelihood of the corresponding benefits and risks.

The estimated oil reserves used for oilspill risk calculations

in this report correspond to those used by the Bureau of Land Management (BLM) in preparing the draft EIS, i. e., they are "risked mean estimates," the amount of oil expected to result from the proposed sale. Risked mean estimates account for the possibility that oil may not be found in economically recoverable quantities in some or all of the tracts. For oilspill calculations, the lease area was divided into smaller subareas than those used by BLM; the individual oil volume estimates for each of these subareas are considered proprietary information. For the entire proposed leasing area, the risked mean estimate of oil reserves is 493 million barrels. The risked mean estimate of reserves from existing leases is 7.9 million barrels. OVer the 30 year life of the Sale 56 leases, BLM estimates that 1.6 billion barrels of oil from other sources, such as imports, will be transported by tankers through the study area.

Probability of Oilspills Occurring

Statistical distributions for estimating probabilities of oilspill occurrence were taken from Devanney and Stewart (1974) and Stewart (1975), and from USGS files of offshore platform accidents. Besides the fundamental assumption that realistic estimates of future spill frequencies can be based on past OCS experience, use of these distributions requires the further assumptions that spills occur independently of each other (as a Poisson process), and that

spill rate is dependent on volume of oil produced and handled. The first assumption - that past spill rates are indicative of future spill rates - might be modified either by assuming a decrease in future spill rates due to experience and improved standards, or by assuming an increase because of unknown conditions in new territory. The assumption that spills occur independently of each other could be modified by assuming a positive correlation (if a spill occurs, conditions are such that more will follow shortly) or by assuming a negative correlation (if a spill occurs, extra precautions are taken). This analysis takes the middle ground between these two assumptions by using the historic spill rates. The final assumption - that the spill rate is a function of the volume of oil handled - might be modified on the basis of size, extent, frequency, or duration of the handling. In the case of tanker transport, for example, the number of port calls and the number of tanker-years have been comtemplated (Stewart, 1976, and Stewart and Kennedy, 1978). This analysis uses volume of oil handled, since all other estimates must ultimately be derived from this quantity.

Spill frequency estimates for oilspills greater than 1000 barrels in size were calculated for production and transportation of oil from Sale 56, from Sale 43, and for existing transportation of oil by tankers within the study area. Table 1 shows the expected number of spills and the most likely number of spills that will occur during the production life of the lease area. Figure 7

Table 1. -- Oilspill probability estimates for spills greater than 1000 barrels resulting from OCS Lease Sale 56, from existing Federal leases, or from existing oil transportation in the South Atlantic area.

	Expected number of spills (mean).	Most likely number of spills (mode).	Probability of one or more spills.
Sale 56	3.0	2	0.95
Sale 43 (existing)	0.05	0	0.05
Sales 56 and 43	3.0	2	0.95
Existing transportation	3.1	3	0.96
Sales 56 and 43 plus existing transportation	6.2	6	0.99+

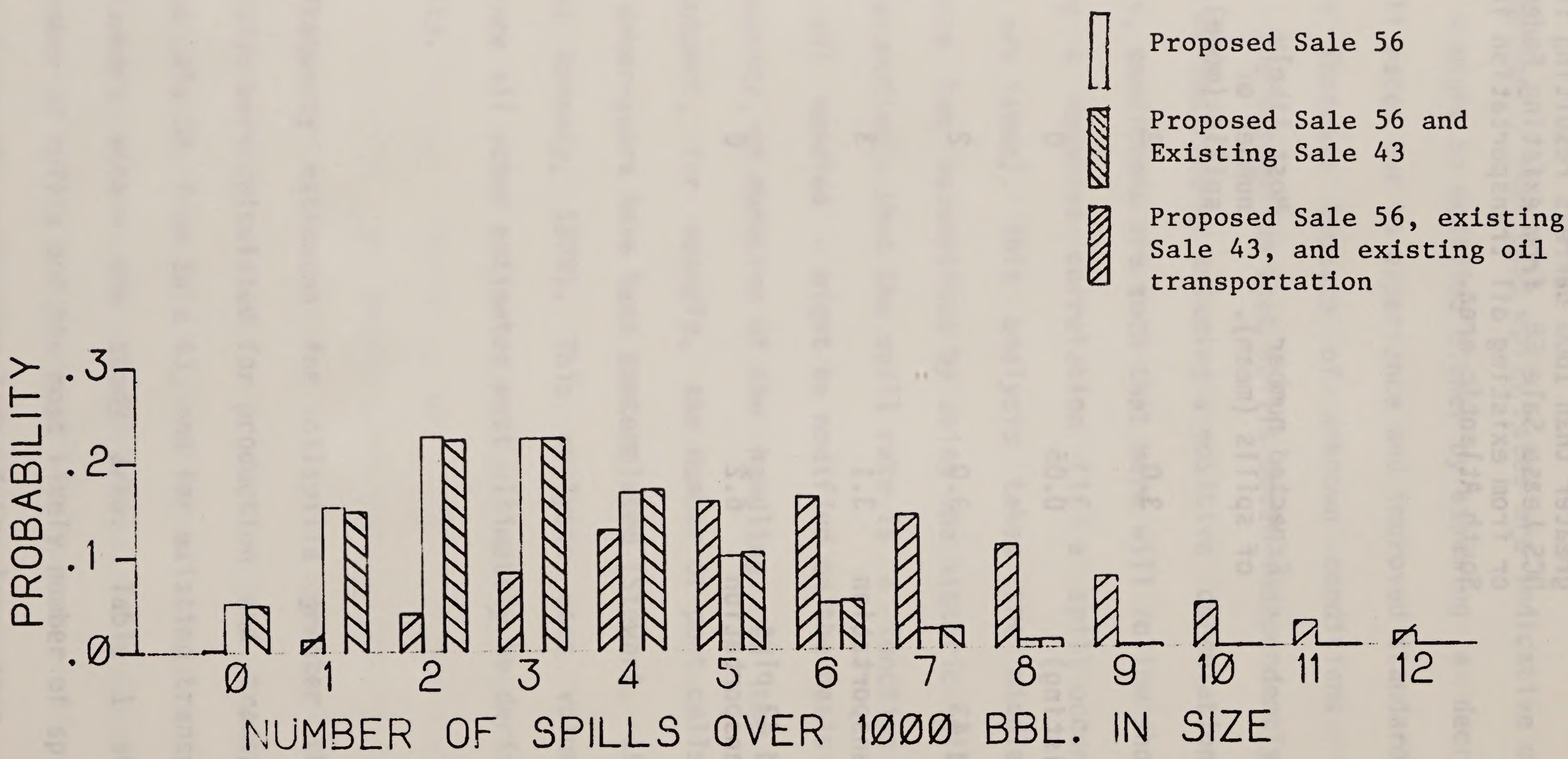

Figure 7.--Estimated frequency distribution for oilspills greater than 1000 barrels occurring during the production life of the proposed lease area for South Atlantic OCS Lease Sale 56.

shows the probability that 0, 1, 2, ..., N spills will occur.

Oilspill Trajectory Simulations

The trajectory simulation portion of the model consists of a large number of hypothetical oilspill trajectories which, collectively, represent both the general trend and the variability of winds and currents, and which can be described in statistical terms. Representations of the monthly surface water velocity field were based upon three years of satellite observations supplied by NASA to BLM. Each year was used for one third of the trajectory simulations, to provide a stochastic representation of the currents. Short-term patterns in wind variability were characterized by probability matrices for successive 3-hour velocity transitions. A first-order Markov process with 41 wind velocity states (eight compass directions by five wind speed classes, plus the calm condition) was assumed. Wind transition matrices were calculated from the U.S. Weather Service records from Charleston (station number 13880), Savannah (station number 3822), and Cape Kennedy (station number 12868). The study area was divided into zones such that a simulated oilspill would, depending upon its location, be directed by the matrix of the appropriate wind station. JAYCOR (1979) compared winds observed at Charleston, S. C. with winds observed some 200 km offshore to the east on an NDBO meteorological data buoy over a one year period, and found

that offshore wind speed averaged 1.8 times the coastal wind speed. This factor was applied to the Charleston and Savannah wind speeds; the Cape Kennedy wind data did not appear to require this adjustment.

Five hundred hypothetical oilspill trajectories were simulated in Monte-Carlo fashion for each of the four seasons from 13 potential oilspill locations in the proposed lease areas, 3 locations in the existing lease areas, and from 28 locations along the transportation network. Each potential spill source was represented as either a single point (e.g., a small portion of the lease area), or as a straight line with the potential spills uniformly distributed along the line (e.g., a transportation route). Surface transport of the oil slick for each spill was simulated as a series of straight-line displacements of a point under the joint influence of winds and currents for a 3-hour period. The wind transition probability matrix was randomly sampled each period for a new wind speed and direction, and the current velocity was updated as the spill changed location or the simulated month changed. The wind drift factor was taken to be 0.035 with a drift angle of 20 degrees clockwise. As the simulated oilspill was moved, any contacts with targets were recorded. Spill movement continued until the spill hit land, moved off of the map, or aged more than 30 days.

It should be emphasized that the trajectories simulated by the

model represent only hypothetical pathways of oil slicks and do not involve any direct consideration of cleanup, dispersion, or weathering processes which would determine the quantity or quality of oil that may eventually come in contact with targets. An implicit analysis of weathering and decay can be considered by noting the age of simulated oilspills when they contact targets. For this analysis, three time periods were selected: 3 days, to represent diminished toxicity of the spill; 10 days, to allow for deployment of cleanup equipment; and 30 days, since most spills are difficult to track or locate after this time.

Each entry of Tables 2, 3, and 4 represents the probability (expressed as percent chance) that, if a spill starts from a certain location, it will contact a particular target within 3, 10, or 30 days. Tables 5 through 10 show similar probabilities for land segments. These conditional probabilities consider, for targets, that the targets may not be vulnerable to oilspills for the entire year: a target which is vulnerable for only 1 month, for example, could have a conditional probability no higher than about 1/12.

Combined Analysis of Oilspill Occurrence and Oilspill Trajectory Simulations

Data in Figure 7 indicates the probabilities of different

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Table 2. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain target within 3 days.

Target	Hypothetical Spill Location																				
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
Land	n	n	2	2	n	n	n	n	n	n	n	n	n	n	n	1	2	1	5	n	n
Brown Pelican	n	n	n	n	n	n	1	n	n	n	n	1	n	n	n	n	n	n	12	n	n
Marine Turtle	n	n	2	2	n	n	n	n	n	n	n	n	n	n	n	1	1	1	n	n	n
Onslow Bay Live Bot.	n	n	57	n	2	4	n	n	n	n	n	n	n	n	n	n	15	n	58	n	n
Wildlife Conser.	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Parks (May-Oct)	n	n	2	2	n	n	n	n	n	n	n	n	n	n	n	1	1	1	5	n	n
Parks (Nov-Apr)	n	n	3	2	n	n	n	n	n	n	n	n	n	n	n	1	3	2	4	n	n
Blkbrd, Sapelo, Wolf	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Gray's Reef	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Cape Romain Wild.	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Monitor	n	n	n	12	2	n	n	n	n	n	n	n	n	n	n	12	7	7	n	n	n
Tourist Beaches, NC	n	n	1	2	n	n	n	n	n	n	n	n	n	n	n	1	1	1	3	n	n
Tourist Beaches, SC	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Tourist Beaches, GA	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Tourist Beaches, FL	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Coastal Inlets, NC	n	n	2	1	n	n	n	n	n	n	n	n	n	n	n	1	1	1	9	n	n
Coastal Inlets, SC	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Coastal Inlets, GA	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Coastal Inlets, FL	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Historic Sites	n	n	1	9	1	n	n	n	n	n	n	n	n	n	n	7	6	6	5	n	n
Prehistoric Sites	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Target	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
Land	n	8	14	n	n	n	n	n	2	3	n	n	n	n	1	13	n	n	9	n	4
Brown Pelican	n	4	31	1	n	n	n	n	8	6	n	n	n	n	1	n	n	n	11	n	n
Marine Turtle	n	4	11	n	n	n	n	n	2	1	n	n	n	n	n	10	n	n	2	n	5
Onslow Bay Live Bot.	n	n	n	n	n	n	n	3	1	44	n	n	n	n	n	n	n	n	n	1	7
Wildlife Conser.	n	13	1	n	n	n	n	n	n	n	n	n	n	n	1	17	n	n	7	n	n
Parks (May-Oct)	n	n	5	n	n	n	n	n	n	3	n	n	n	n	n	10	n	n	6	n	5
Parks (Nov-Apr)	n	n	4	n	n	n	n	n	n	3	n	n	n	n	n	9	n	n	5	n	5
Blkbrd, Sapelo, Wolf	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Gray's Reef	1	7	1	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n
Cape Romain Wild.	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
Monitor	n	n	n	n	n	n	n	n	n	1	1	n	n	n	n	n	n	n	n	n	7
Tourist Beaches, NC	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	4
Tourist Beaches, SC	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n
Tourist Beaches, GA	n	2	12	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n
Tourist Beaches, FL	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	13	n	n	n	n	n
Coastal Inlets, NC	n	n	n	n	n	n	n	n	n	6	n	n	n	n	n	n	n	n	n	n	7
Coastal Inlets, SC	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	13	n	n
Coastal Inlets, GA	n	13	21	n	n	n	n	n	4	n	n	n	n	n	n	n	n	n	n	n	n
Coastal Inlets, FL	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	16	n	n	n	n	n
Historic Sites	n	2	7	n	n	n	n	n	1	4	1	n	n	n	n	12	n	n	8	n	7
Prehistoric Sites	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Note: n = less than 0.5 percent

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Table 3. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain target within 10 days.

Target	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
	Hypothetical Spill Location																				
Land	1	2	18	11	4	3	3	7	n	2	1	9	4	3	1	7	13	9	13	2	5
Brown Pelican	n	n	1	1	n	1	7	8	1	2	2	6	6	3	n	n	1	1	13	6	7
Marine Turtle	n	n	15	8	3	1	2	4	n	1	1	6	3	2	n	5	9	6	4	2	3
Onslow Bay Live Bot.	n	n	65	2	5	18	n	n	6	2	3	1	1	1	n	1	25	2	64	4	n
Wildlife Conser.	1	I	n	n	n	1	3	5	n	1	1.	5	2	2	1	n	n	n	n	3	4
Parks (May-Oct)	n	1	15	10	3	2	1	1	n	1	1	4	2	1	n	7	11	7	9	1	1
Parks (Nov-Apr)	1	1	11	6	3	1	1	1	n	1	1	3	1	1	1	4	9	5	8	n	1
Blkbrd, Sapelo, Wolf	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	1
Gray's Reef	n	n	n	n	n	n	n	6	n	n	n	2	2	1	n	n	n	n	n	n	2
Cape Romain Wild.	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n
Monitor	n	n	10	19	7	2	n	n	2	1	1	n	n	n	n	18	17	12	4	n	n
Tourist Beaches, NC	n	1	14	9	3	1	n	n	n	n	n	n	n	n	n	6	10	6	7	n	n
Tourist Beaches, SC	n	n	n	n	n	n	1	1	n	n	n	n	n	n	n	n	n	n	n	1	2
Tourist Beaches, GA	n	n	n	n	n	n	n	2	n	1	1	3	3	1	n	n	n	n	n	n	n
Tourist Beaches, FL	n	n	n	n	n	n	n	n	n	n	n	3	1	1	n	n	n	n	n	n	n
Coastal Inlets, NC	n	1	15	7	3	2	n	n	n	n	n	n	n	n	1	3	10	5	16	n	n
Coastal Inlets, SC	n	n	n	n	n	1	5	3	n	1	n	n	n	n	n	n	n	n	n	4	5
Coastal Inlets, GA	n	n	n	n	n	n	n	6	n	1	1	5	4	2	n	n	n	n	n	n	2
Coastal Inlets, FL	n	n	n	n	n	n	n	n	n	n	n	3	1	1	n	n	n	n	n	n	n
Historic Sites	1	1	16	18	7	2	1	1	2	1	1	4	2	1	1	15	20	12	10	1	2
Prehistoric Sites	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	1

Target	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
Land	5	23	29	6	3	3	1	2	6	10	3	1	1	1	6	25	4	1	17	1	15
Brown Pelican	8	13	38	6	3	3	1	1	11	8	n	n	n	n	9	3	3	1	18	n	1
Marine Turtle	3	12	20	4	2	2	1	2	4	4	2	n	n	n	5	16	2	1	6	n	11
Onslow Bay Live Bot.	1	n	n	1	1	1	3	12	5	48	n	n	n	n	1	1	1	5	4	7	11
Wildlife Conser.	3	21	8	4	1	1	1	n	2	n	1	n	n	n	6	21	1	n	15	n	n
Parks (May-Oct)	1	2	9	3	1	2	1	1	1	7	2	n	1	n	2	14	1	n	7	1	12
Parks (Nov-Apr)	1	1	8	3	1	1	1	1	2	6	2	1	1	n	2	12	1	n	6	1	10
Blkbrd, Sapelo, Wolf	1	4	2	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n
Gray's Reef	5	13	6	1	n	1	n	n	3	n	n	n	n	n	n	1	1	n	n	n	n
Cape Romain Wild.	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n
Monitor	n	n	n	n	n	n	1	3	2	4	5	1	1	n	n	n	n	1	1	3	14
Tourist Beaches, NC	n	n	n	n	n	n	n	1	n	5	2	n	1	n	n	n	n	n	n	1	11
Tourist Beaches, SC	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n
Tourist Beaches, GA	2	6	18	3	1	2	n	n	3	n	n	n	n	n	n	1	2	n	n	n	n
Tourist Beaches, FL	n	n	1	2	n	1	n	n	n	n	n	n	n	n	3	17	1	n	n	n	n
Coastal Inlets, NC	n	n	n	n	n	n	n	1	1	12	1	n	n	n	n	n	n	n	n	1	13
Coastal Inlets, SC	1	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	20	n	n
Coastal Inlets, GA	5	26	32	5	2	2	n	n	7	n	n	n	n	n	n	3	2	1	n	n	n
Coastal Inlets, FL	n	n	1	2	1	1	n	n	n	n	n	n	n	n	1	20	1	n	n	n	n
Historic Sites	2	6	14	4	1	1	1	3	4	8	5	1	1	n	2	16	2	1	10	2	19
Prehistoric Sites	n	2	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	1	n	n

Note: n = less than n.5 percent

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Table 4. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain target within ~~10~~ 30 days.

Target	Hypothetical Spill Location																				
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
Land	5	5	38	20	10	16	25	33	9	15	16	25	23	19	5	15	29	15	35	19	29
Brown Pelican	n	n	6	2	1	7	23	28	4	9	9	16	17	12	n	1	4	1	17	15	25
Marine Turtle	1	1	24	13	6	8	14	19	5	8	9	16	15	12	1	9	17	9	15	11	16
Onslow Bay Live Bot.	n	n	66	5	7	28	7	4	14	9	9	6	4	7	n	3	28	4	66	13	5
Wildlife Conser.	3	3	1	1	1	3	17	19	4	7	7	11	11	8	3	2	1	1	2	13	20
Parks (May-Oct)	1	2	27	15	7	10	6	7	5	6	6	10	8	7	1	11	20	10	22	7	6
Parks (Nov-Apr)	2	1	16	9	4	5	4	4	3	4	5	6	6	5	2	7	14	7	14	4	4
Blkbrd, Sapelo, Wolf	n	n	n	n	n	n	1	4	n	n	n	2	2	1	n	n	n	n	n	1	3
Gray's Reef	n	n	n	n	n	n	2	10	n	1	1	5	6	3	n	n	n	n	n	1	5
Cape Romain Wild.	n	n	n	n	n	1	4	1	1	1	1	1	1	1	n	n	n	n	n	4	4
Monitor	n	n	15	23	9	6	2	1	5	3	3	2	2	3	1	20	23	14	9	3	1
Tourist Beaches, NC	2	2	25	14	7	7	1	n	3	2	3	1	1	2	1	11	19	10	18	2	n
Tourist Beaches, SC	n	n	n	n	n	n	7	8	1	1	1	1	2	1	n	n	n	n	n	4	9
Tourist Beaches, GA	n	n	n	n	n	n	2	7	1	2	3	8	9	5	n	n	n	n	n	1	3
Tourist Beaches, FL	n	n	n	n	n	n	n	n	1	1	1	5	2	2	n	n	n	n	n	n	n
Coastal Inlets, NC	2	2	28	12	6	10	1	1	4	2	3	1	1	2	3	8	20	8	32	4	1
Coastal Inlets, SC	n	n	n	n	n	3	21	19	2	4	4	3	5	4	n	n	n	n	1	15	22
Coastal Inlets, GA	n	n	n	n	n	n	7	17	2	5	5	13	15	9	n	n	n	n	n	3	10
Coastal Inlets, FL	n	n	n	n	n	n	n	n	1	2	2	4	1	2	n	n	n	n	n	n	n
Historic Sites	2	3	28	23	11	9	8	9	6	8	8	11	11	8	3	18	29	16	21	8	8
Prehistoric Sites	n	n	n	n	n	n	3	3	n	1	1	1	1	1	n	n	n	n	1	2	4

	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
Land	27	44	46	25	19	18	13	13	15	27	7	1	3	4	22	37	17	13	29	6	26
Brown Pelican	20	25	44	15	13	13	7	5	14	11	n	n	n	n	21	9	9	7	23	1	3
Marine Turtle	17	24	29	16	12	12	7	8	8	13	4	n	1	1	13	23	11	8	12	4	15
Onslow Bay Live Bot.	5	3	2	5	7	6	10	18	8	50	1	n	n	n	7	4	6	11	10	10	13
Wildlife Conser.	14	31	16	11	8	8	6	3	5	2	1	n	1	2	15	26	7	5	21	n	1
Parks (May-Oct)	9	8	14	10	8	8	5	8	4	18	5	n	1	1	8	19	8	6	11	5	17
Parks (Nov-Apr)	6	5	12	7	5	4	4	5	4	11	3	1	1	2	6	15	5	4	8	2	14
Blkbrd, Sapelo, Wolf	2	6	4	2	1	1	n	n	1	n	n	n	n	n	n	1	1	n	n	n	n
Gray's Reef	9	16	10	4	3	4	1	n	3	n	n	n	n	n	1	2	2	1	n	n	n
Cape Romain Wild.	1	1	n	1	1	1	1	n	1	n	n	n	n	n	1	n	n	1	6	n	n
Monitor	2	1	1	2	3	2	3	6	3	8	7	1	2	n	3	2	2	4	2	4	17
Tourist Beaches, NC	1	1	1	2	2	2	3	6	2	14	5	n	1	1	1	1	2	4	2	4	16
Tourist Beaches, SC	3	5	1	1	1	1	1	1	1	n	n	n	n	n	1	1	1	1	6	n	n
Tourist Beaches, GA	8	12	24	9	5	7	2	1	4	n	n	n	n	n	1	6	5	2	1	n	n
Tourist Beaches, FL	2	1	3	4	2	2	1	n	n	n	n	n	n	n	8	17	2	1	n	n	n
Coastal Inlets, NC	1	1	1	1	2	1	3	7	3	25	3	n	1	1	2	1	2	4	4	4	19
Coastal Inlets, SC	7	12	3	3	4	3	4	2	3	n	n	n	n	n	2	2	2	3	25	n	n
Coastal Inlets, GA	18	37	42	15	9	11	4	2	9	n	n	n	n	n	1	9	8	4	2	n	n
Coastal Inlets, FL	1	1	3	4	2	2	1	n	n	n	n	n	n	n	3	22	3	1	n	n	n
Historic Sites	12	14	21	11	9	8	7	9	8	18	8	1	2	2	7	21	9	8	15	5	24
Prehistoric Sites	1	4	1	1	1	n	1	n	1	n	n	n	n	n	3	1	1	n	2	n	n

Note: n = less than 0.5 percent

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Table 5. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain land segment (set 1) within 3 days.

Land Segment	Hypothetical Spill Location P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
3	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
4	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	1	1	1	n	n	n
5	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
6	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
8	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n
13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
17	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
18	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
19	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
20	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Land Segment	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
4	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1
5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2
6	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2
8	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n
9	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n
13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	8	n	n
16	n	6	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
17	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
18	n	n	13	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n
19	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n
20	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n	n	n	n

Note: n = less than 0.5 percent.
Land segments for which all probabilities are less than 0.5 percent are not shown.

Table 6. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain land segment (set 1) within 10 days.

Land Segment	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
	Hypothetical Spill Location																				
2	1	1	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n
3	n	1	1	4	1	n	n	n	n	n	n	n	n	n	1	4	2	3	n	n	n
4	n	n	3	6	3	n	n	n	n	n	n	n	n	n	n	3	7	5	1	n	n
5	n	n	6	1	n	n	n	n	n	n	n	n	n	n	n	n	2	1	1	n	n
6	n	n	6	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	1	n	n
7	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
8	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n
9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n
12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
13	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	2	1
14	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	1
15	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	1
16	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	1
17	n	n	n	n	n	n	n	3	n	n	n	n	1	n	n	n	n	n	n	n	1
18	n	n	n	n	n	n	n	1	n	1	n	2	2	1	n	n	n	n	n	n	n
19	n	n	n	n	n	n	n	n	n	n	n	2	1	1	n	n	n	n	n	n	n
20	n	n	n	n	n	n	n	n	n	n	1	4	n	1	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
23	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Land Segment	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
3	n	n	n	n	n	n	n	n	n	1	1	n	1	n	n	n	n	n	n	n	3
4	n	n	n	n	n	n	n	1	n	2	1	n	n	n	n	n	n	n	n	1	5
5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4
6	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	3
7	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n
8	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n	n	n	n
9	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n	n	n	n
12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n
13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	13	n	n
14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
15	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
16	1	10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
17	1	7	2	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n
18	2	3	19	2	1	1	n	n	4	n	n	n	n	n	n	1	2	n	n	n	n
19	1	1	7	2	1	1	n	n	n	n	n	n	n	n	n	6	1	n	n	n	n
20	n	n	1	2	n	n	n	n	n	n	n	n	n	n	1	16	1	n	n	n	n
21	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	1	n	n	n	n	n
23	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n

Note: n = less than 0.5 percent.
Land segments for which all probabilities are less than 0.5 percent are not shown.

Table 7. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain land segment (set 1) within 30 days.

Land Segment	Hypothetical Spill Location P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
1	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
2	4	3	n	1	1	n	n	n	n	n	n	n	n	n	3	2	1	1	n	n	n
3	1	1	4	6	3	2	n	n	1	1	1	n	1	n	2	6	5	4	2	1	n
4	n	n	8	10	5	2	1	n	1	1	1	1	n	1	n	6	12	7	4	1	n
5	n	n	10	2	1	1	n	n	n	n	n	n	n	n	n	1	5	2	3	n	n
6	n	n	10	1	n	2	n	n	1	1	1	n	n	1	n	n	3	1	7	1	n
7	n	n	1	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n
8	n	n	3	n	n	2	n	n	1	n	n	n	n	n	n	n	1	n	7	n	n
9	n	n	1	n	n	2	n	n	n	n	n	n	n	n	n	n	1	n	7	n	n
10	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
12	n	n	n	n	n	1	2	1	n	1	1	n	1	1	n	n	n	n	n	3	3
13	n	n	n	n	n	1	6	5	1	2	1	1	1	1	n	n	n	n	n	4	5
14	n	n	n	n	n	n	4	4	n	1	1	1	1	1	n	n	n	n	n	2	6
15	n	n	n	n	n	n	2	4	n	n	n	1	1	n	n	n	n	n	n	1	3
16	n	n	n	n	n	n	4	4	n	n	1	1	1	1	n	n	n	n	n	2	4
17	n	n	n	n	n	n	3	7	n	1	1	3	3	2	n	n	n	n	n	1	4
18	n	n	n	n	n	n	1	5	1	3	2	6	7	4	n	n	n	n	n	n	2
19	n	n	n	n	n	n	1	2	1	1	2	5	5	4	n	n	n	n	n	n	1
20	n	n	n	n	n	n	n	n	n	1	2	6	1	3	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	n	n	2	1	1	n	1	n	n	n	n	n	n	n
22	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
23	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Land Segment	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
1	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n
2	n	n	n	n	n	n	n	n	n	n	1	1	1	3	n	n	n	n	n	n	1
3	n	n	n	1	1	n	1	2	1	2	3	1	1	1	1	n	1	1	n	1	5
4	1	n	n	1	1	1	1	3	1	4	2	n	1	n	1	1	1	1	1	2	9
5	n	n	n	n	n	n	n	1	n	2	n	n	n	n	n	n	n	n	n	1	6
6	n	n	n	1	n	n	1	2	1	5	n	n	n	n	n	n	1	1	1	1	3
7	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n	n	n	1
8	n	n	n	n	n	n	n	1	1	6	n	n	n	n	n	n	n	1	n	1	1
9	n	n	n	n	n	n	n	1	n	4	n	n	n	n	n	n	n	n	1	n	n
10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
12	1	n	n	n	1	n	1	n	n	n	n	n	n	n	n	n	n	1	4	n	n
13	1	1	1	1	1	1	1	1	1	n	n	n	n	n	1	1	1	1	15	n	n
14	2	2	n	1	1	n	1	n	1	n	n	n	n	n	n	n	n	n	2	n	n
15	2	4	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	1	n	n
16	2	12	1	1	1	1	1	n	1	n	n	n	n	n	n	1	1	n	2	n	n
17	4	10	5	2	1	1	1	n	2	n	n	n	n	n	n	1	1	1	1	n	n
18	7	8	24	7	5	6	2	1	5	n	n	n	n	n	1	5	4	2	n	n	n
19	6	4	11	6	3	4	2	1	1	n	n	n	n	n	1	8	3	2	n	n	n
20	1	1	2	4	2	2	1	n	n	n	n	n	n	n	1	17	2	1	n	n	n
21	n	n	n	n	1	n	n	n	n	n	n	n	n	n	2	2	2	n	n	n	n
22	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n
23	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	6	n	n	n	n	n	n

Note: n = less than 0.5 percent.
Land segments for which all probabilities are less than 0.5 percent are not shown.

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Table 8. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain land segment (set 2) within 3 days.

Land Segment	Hypothetical Spill Location P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
2	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	1	1	1	n	n	n
3	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	1	1	n	n	n
4	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
7	n	n	n	n	n	n	n	n	n	n	n	n	n	n.	n	n	n	n	3	n	n
8	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n
11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
15	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
18	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
19	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
22	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Land Segment	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
4	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4
7	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n
8	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n
11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	9	n	n
13	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
14	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
15	n	5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
16	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
18	n	n	10	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n
19	n	n	4	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	11	n	n	n	n	n
22	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n

Note: n = less than 0.5 percent.
Land segments for which all probabilities are less than 0.5 percent are not shown.

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Table 9. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain land segment (set 2) within 10 days.

Land Segment	Hypothetical Spill Location P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
2	1	2	2	5	2	n	n	n	n	n	n	n	n	n	1	5	4	5	1	n	n
3	n	n	2	4	2	n	n	n	n	n	n	n	n	n	n	1	5	3	1	n	n
4	n	n	13	1	n	n	n	n	n	n	n	n	n	n	n	1	4	1	1	n	n
5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
6	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
7	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n
8	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n
11	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	2	2
13	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	1
14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
15	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	1
16	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	1
17	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n
18	n	n	n	n	n	n	n	n	n	n	n	1	1	n	n	n	n	n	n	n	n
19	n	n	n	n	n	n	n	n	n	1	n	2	1	1	n	n	n	n	n	n	n
20	n	n	n	n	n	n	n	n	n	n	n	1	1	n	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n
22	n	n	n	n	n	n	n	n	n	n	n	2	n	1	n	n	n	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
25	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Land Segment	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
2	n	n	n	n	n	n	n	1	n	1	2	n	1	1	n	n	n	n	n	1	4
3	n	n	n	n	n	n	n	n	n	1	1	n	n	n	n	n	n	n	n	1	3
4	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	7
5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
6	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n
7	n	n	n	n	n	n	n	n	n	4	n	n	n	n	n	n	n	n	n	n	n
8	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n
11	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	16	n	n
13	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
14	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
15	n	9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
16	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
17	1	3	2	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n
18	1	2	15	1	1	1	n	n	3	n	n	n	n	n	n	1	1	n	n	n	n
19	1	1	9	2	1	1	n	n	1	n	n	n	n	n	n	1	1	n	n	n	n
20	n	n	2	1	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n
21	n	n	1	2	n	1	n	n	n	n	n	n	n	n	n	15	1	n	n	n	n
22	n	n	n	1	n	n	n	n	n	n	n	n	n	n	1	6	1	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n
25	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n

Note: n = less than 0.5 percent.
Land segments for which all probabilities are less than 0.5 percent are not shown.

Table 10. -- Probabilities (expressed in percent chance) that an oilspill starting at a particular location will contact a certain land segment (set 2) within 30 days.

Land Segment	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	T1	T2	T3	T4	T5	T6	T7
	Hypothetical Spill Location																				
2	5	4	7	9	6	2	1	n	2	1	1	1	1	1	5	10	9	8	4	2	1
3	n	n	5	7	3	2	n	n	1	1	n	n	n	n	n	3	8	4	2	1	n
4	n	n	20	3	1	4	n	n	1	1	1	n	n	1	n	2	9	2	10	1	n
5	n	n	1	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n
6	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n
7	n	n	4	n	1	3	n	n	1	n	n	n	n	n	n	n	1	n	9	n	n
8	n	n	1	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n
9	n	n	n	n	n	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
10	n	n	n	n	n	1	1	n	n	n	n	n	n	n	n	n	n	n	1	1	1
11	n	n	n	n	n	1	12	9	1	3	2	2	3	2	n	n	n	n	n	8	11
12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1
13	n	n	n	n	n	n	3	5	n	n	n	1	1	n	n	n	n	n	n	2	5
14	n	n	n	n	n	n	1	1	n	n	n	n	n	n	n	n	n	n	n	n	n
15	n	n	n	n	n	n	2	3	n	n	1	1	1	1	n	n	n	n	n	1	3
16	n	n	n	n	n	n	1	2	n	n	n	1	1	n	n	n	n	n	n	1	2
17	n	n	n	n	n	n	2	4	n	n	n	2	2	1	n	n	n	n	n	1	2
18	n	n	n	n	n	n	1	4	1	2	2	4	5	3	n	n	n	n	n	n	2
19	n	n	n	n	n	n	1	3	1	2	2	5	5	3	n	n	n	n	n	n	1
20	n	n	n	n	n	n	n	n	n	n	n	2	2	1	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	n	n	n	1	3	1	1	n	n	n	n	n	n	n
22	n	n	n	n	n	n	n	n	n	3	2	4	n	3	n	n	n	n	n	n	n
23	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
25	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Land Segment	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28
2	n	n	1	1	1	1	1	3	2	4	5	1	2	4	1	1	1	2	1	2	8
3	n	n	n	n	1	n	1	2	1	2	2	n	n	n	n	n	n	1	1	1	6
4	1	n	n	1	1	1	1	3	1	8	n	n	n	n	1	1	1	1	1	2	10
5	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	1
6	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n
7	n	n	n	n	n	n	n	1	1	7	n	n	n	n	n	n	n	n	1	1	1
8	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	1	n	n
9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n
11	3	4	1	2	2	2	3	1	1	n	n	n	n	n	1	1	1	2	20	n	n
12	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
13	2	5	1	n	n	n	1	n	1	n	n	n	n	n	n	n	n	n	2	n	n
14	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
15	2	10	1	1	1	1	n	n	1	n	n	n	n	n	n	1	n	n	1	n	n
16	1	5	2	1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
17	2	5	4	2	1	1	n	n	1	n	n	n	n	n	n	1	1	n	n	n	n
18	5	6	18	5	3	4	1	1	4	n	n	n	n	n	1	3	3	1	n	n	n
19	6	4	13	6	4	4	2	1	1	n	n	n	n	n	1	3	3	1	n	n	n
20	2	2	4	2	1	1	1	n	n	n	n	n	n	n	n	2	1	1	n	n	n
21	1	1	2	3	1	2	1	n	n	n	n	n	n	n	n	16	1	1	n	n	n
22	n	n	1	2	2	1	1	n	n	n	n	n	n	n	3	7	3	n	n	n	n
23	n	n	n	n	n	n	n	n	n	n	n	n	n	n	1	n	n	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n
25	n	n	n	n	n	n	n	n	n	n	n	n	n	n	7	n	n	n	n	n	n

Note: n = less than 0.5 percent.
Land segments for which all probabilities are less than 0.5 percent are not shown.

numbers of oilspills occurring. Tables 2 through 10 indicate the probabilities that targets or land segments will be contacted, given that an oilspill occurs. Combining these two sets of probabilities yields the chances that oilspills will occur and contact targets or land segments.

There is a critical difference between the conditional probabilities calculated in the previous section and the overall probabilities calculated in this section. Conditional probabilities depend only on the winds and currents of the study area - elements over which the decisionmaker has no control. Overall probabilities, on the other hand, will depend not only on the physical conditions, but also on the course of action chosen by the decisionmaker, e. g. choosing to sell or not to sell the lease tracts.

Table 11 shows the probabilities (expressed in percent chance) of one or more oilspills, the most likely number of oilspills, and the expected number of oilspills occurring and contacting targets within periods of 3, 10, and 30 days, over the production life of the lease area. Tables 12 and 13 show similar probabilities for land segments. Only the impact of Federal oil and gas leasing is shown in Tables 11 through 13. Tables of probabilities which show the effects of existing oil transportation combined with existing and proposed leasing are presented in Appendix D.

Table 11. -- Probabilities (expressed in percent chance) of one or more spills, the most likely number of spills, and the expected number of spills occurring and contacting targets over the production life of the lease area.

Target	Within 3 days: Proposed			Within 3 days: Existing and Proposed			Within 10 days: Proposed			Within 10 days: Existing and Proposed			Within 30 days: Proposed			Within 30 days: Existing and Proposed		
	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean
Land	11	0	0.1	11	0	0.1	26	0	0.3	27	0	0.3	50	0	0.7	51	0	0.7
Brown Pelican	23	0	0.3	23	0	0.3	30	0	0.4	31	0	0.4	40	0	0.5	40	0	0.5
Marine Turtle	8	0	0.1	8	0	0.1	17	0	0.2	17	0	0.2	33	0	0.4	33	0	0.4
Onslow Bay Live Bot.	21	0	0.2	21	0	0.2	26	0	0.3	26	0	0.3	31	0	0.4	31	0	0.4
Wildlife Conser.	1	0	0.0	1	0	0.0	7	0	0.1	7	0	0.1	19	0	0.2	20	0	0.2
Parks (May-Oct)	5	0	0.0	5	0	0.0	11	0	0.1	12	0	0.1	24	0	0.3	24	0	0.3
Parks (Nov-Apr)	4	0	0.0	4	0	0.0	10	0	0.1	10	0	0.1	19	0	0.2	19	0	0.2
Blkbrd, Sapelo, Wolf	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	4	0	0.0	4	0	0.0
Gray's Reef	1	0	0.0	1	0	0.0	6	0	0.1	6	0	0.1	10	0	0.1	10	0	0.1
Cape Romain Wild.	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0
Monitor	1	0	0.0	1	0	0.0	5	0	0.1	5	0	0.1	10	0	0.1	10	0	0.1
Tourist Beaches, NC	1	0	0.0	1	0	0.0	4	0	0.0	4	0	0.0	12	0	0.1	12	0	0.1
Tourist Beaches, SC	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	3	0	0.0	3	0	0.0
Tourist Beaches, GA	8	0	0.1	8	0	0.1	13	0	0.1	13	0	0.1	19	0	0.2	19	0	0.2
Tourist Beaches, FL	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	3	0	0.0
Coastal Inlets, NC	4	0	0.0	4	0	0.0	7	0	0.1	7	0	0.1	16	0	0.2	16	0	0.2
Coastal Inlets, SC	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	7	0	0.1	8	0	0.1
Coastal Inlets, GA	13	0	0.1	14	0	0.1	22	0	0.2	22	0	0.3	32	0	0.4	33	0	0.4
Coastal Inlets, FL	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	3	0	0.0
Historic Sites	7	0	0.1	7	0	0.1	17	0	0.2	17	0	0.2	31	0	0.4	31	0	0.4
Prehistoric Sites	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0

Note: n = less than 0.5 percent.

Table 12. -- Probabilities (expressed in percent chance) of one or more spills, the most likely number of spills, and the expected number of spills occurring and contacting land segments (set 1) over the production life of the proposed lease area.

Land Segment	Within 3 days: Proposed			Within 3 days: Existing and Proposed			Within 10 days: Proposed			Within 10 days: Existing and Proposed			Within 30 days: Proposed			Within 30 days: Existing and Proposed		
	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean
2	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0
3	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	3	0	0.0
4	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	4	0	0.0	4	0	0.0
5	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0
6	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	3	0	0.0	3	0	0.0
7	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0
8	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	3	0	0.0
9	1	0	0.0	1	0	0.0	2	0	0.0	2	0	0.0	3	0	0.0	3	0	0.0
12	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0
13	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0
14	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0
15	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0
16	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0
17	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	6	0	0.1	6	0	0.1
18	8	0	0.1	8	0	0.1	13	0	0.1	14	0	0.2	18	0	0.2	19	0	0.2
19	1	0	0.0	1	0	0.0	5	0	0.0	5	0	0.0	10	0	0.1	10	0	0.1
20	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	2	0	0.0

Note: n = less than 0.5 percent. Those land segments for which all probabilities of one or more spills are less than 0.5 percent are not shown.

Table 13. -- Probabilities (expressed in percent chance) of one or more spills, the most likely number of spills, and the expected number of spills occurring and contacting land segments (set 2) over the production life of the proposed lease area.

Land Segment	Within 3 days: Proposed Prob	Mode	Mean	Within 3 days: Existing and Proposed Prob	Mode	Mean	Within 10 days: Proposed Prob	Mode	Mean	Within 10 days: Existing and Proposed Prob	Mode	Mean	Within 30 days: Proposed Prob	Mode	Mean	Within 30 days: Existing and Proposed Prob	Mode	Mean
2	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	6	0	0.1	7	0	0.1
3	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	3	0	0.0
4	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	5	0	0.0	5	0	0.0
5	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0
6	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0
7	1	0	0.0	1	0	0.0	2	0	0.0	2	0	0.0	4	0	0.0	4	0	0.0
8	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0
11	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	4	0	0.0	4	0	0.0
13	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0
15	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0
16	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0
17	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	4	0	0.0	4	0	0.0
18	7	0	0.1	7	0	0.1	10	0	0.1	10	0	0.1	14	0	0.2	14	0	0.2
19	3	0	0.0	3	0	0.0	7	0	0.1	7	0	0.1	11	0	0.1	11	0	0.1
20	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	3	0	0.0	3	0	0.0
21	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	2	0	0.0
22	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0

Note: n = less than 0.5 percent. Those land segments for which all probabilities of one or more spills are less than 0.5 percent are not shown.

The overall probabilities are also shown graphically in Appendices B and C. Figures B-1 through B-17 are histograms which show probabilities of 1, 2, ... N spills occurring and contacting the targets for periods of 3, 10, and 30 days. Figure C-1 indicates, through circles superimposed on a map of the coastline, the probabilities of one or more spills occurring and contacting land segments (set 1) within 3, 10, and 30 days.

Discussion of Results

Sale of the proposed leases will result in a 0.5 probability of one or more oilspills occurring and contacting land within 30 days. Since the same probability for 3 days is only 0.11, it can be concluded that any oil washing ashore will, most likely, have undergone a substantial amount of weathering. Oilspill risks are distributed along the entire coast of the study area, reflecting the wide distribution of tracts. Detailed analysis indicates that most of the risk to North Carolina is caused by the northern tracts, groups P1 through P5, and that risks to the other states are caused by the southern tracts. The Brunswick, Georgia, to Jacksonville, Florida coastline has the highest risk of being contacted by an oilspill, mostly because transportation routes converge on this area.

The probability that one or more spills will occur and contact a

Brown Pelican rookery within 3 days is 0.23, somewhat higher than that of contacting land. This is because the target has been extended seaward to represent the range of foraging activity. Most (though not all) of the risk to the Brown Pelican arises from sale of the southern tracts.

Existing tanker transportation of oil presents a risk about equal to that of the proposed leases, but the nature of tanker operations tends to spread the risks more evenly along the coast. To the extent that oil from the proposed sale tends to displace some of the existing transportation, the risks of production will be offset by reductions in tanker traffic; this analysis, however, has not made this assumption.

A stochastic oilspill model, such as that presented in this paper, can not be verified by observing an individual oilspill. A number of spills must be observed in order to draw statistical inferences; such a data base rarely exists for a given study area, nor would a responsible researcher propose to create one by spilling oil deliberately. The Cape Hatteras area, however, was the site of intense submarine warfare during World War II, and tanker sinkings during that period provide a data base for verifying the model. Campbell and others (1977) examined tanker sinkings by submarine activity during the first six months of 1942, and were able to identify 15 sinkings of laden tankers just south of Cape Hatteras, between latitudes 33 degrees N and 35 degrees 10

minutes N. During that same period, at least one oilspill was confirmed to have washed ashore on the outer banks south of Cape Hatteras, and it is believed that as many as three oilspills may have come ashore on this portion of coastline. The locations of the 15 tanker sinkings were matched to launch points P3, T2, and T5, and the model's results were used to predict how many of the slicks were likely to come ashore on the outer banks (segments 3, 4, or 5 of set 1). Of the 15 spills, the model estimated that there was only a 0.09 probability that none would come ashore, but that there was a 0.75 probability that between 1 and 3 oilspills would contact the outer banks. This is in good agreement with the observations.

Conclusions

This analysis indicates that OCS Lease Sale 56 will result in an expected 3.0 oilspills occurring off the South Atlantic coast. The probability that one or more oilspills will occur and contact land within 3 days is 0.11; for contacts within 30 days, the probability increases to 0.50.

Risks to land are distributed along the coastline, with most of the risks to North Carolina due to the northernmost tracts, and the risks to other states due to the southern tracts.

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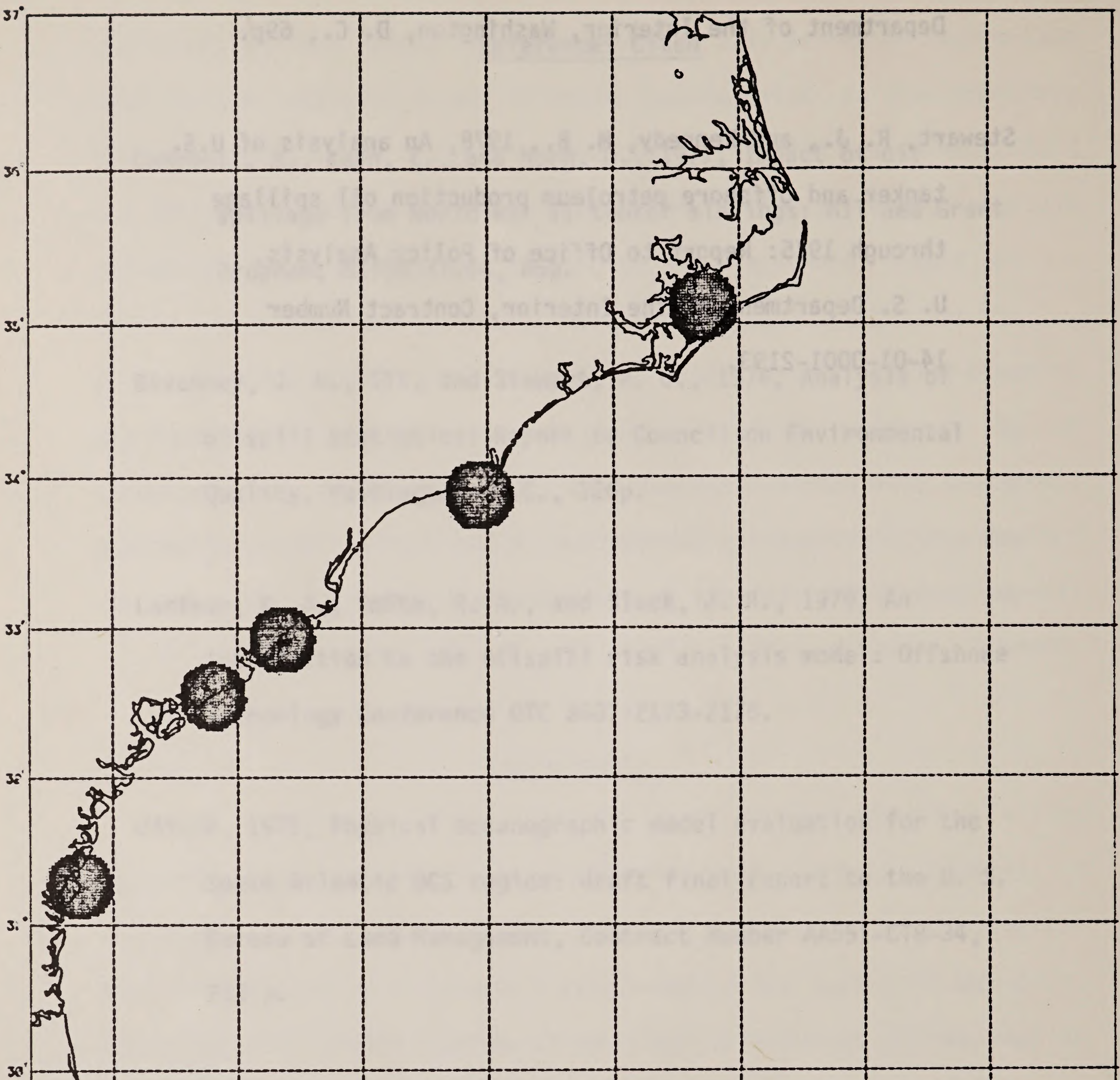

Figure A.1.--Map showing the location of Brown pelican rookeries, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

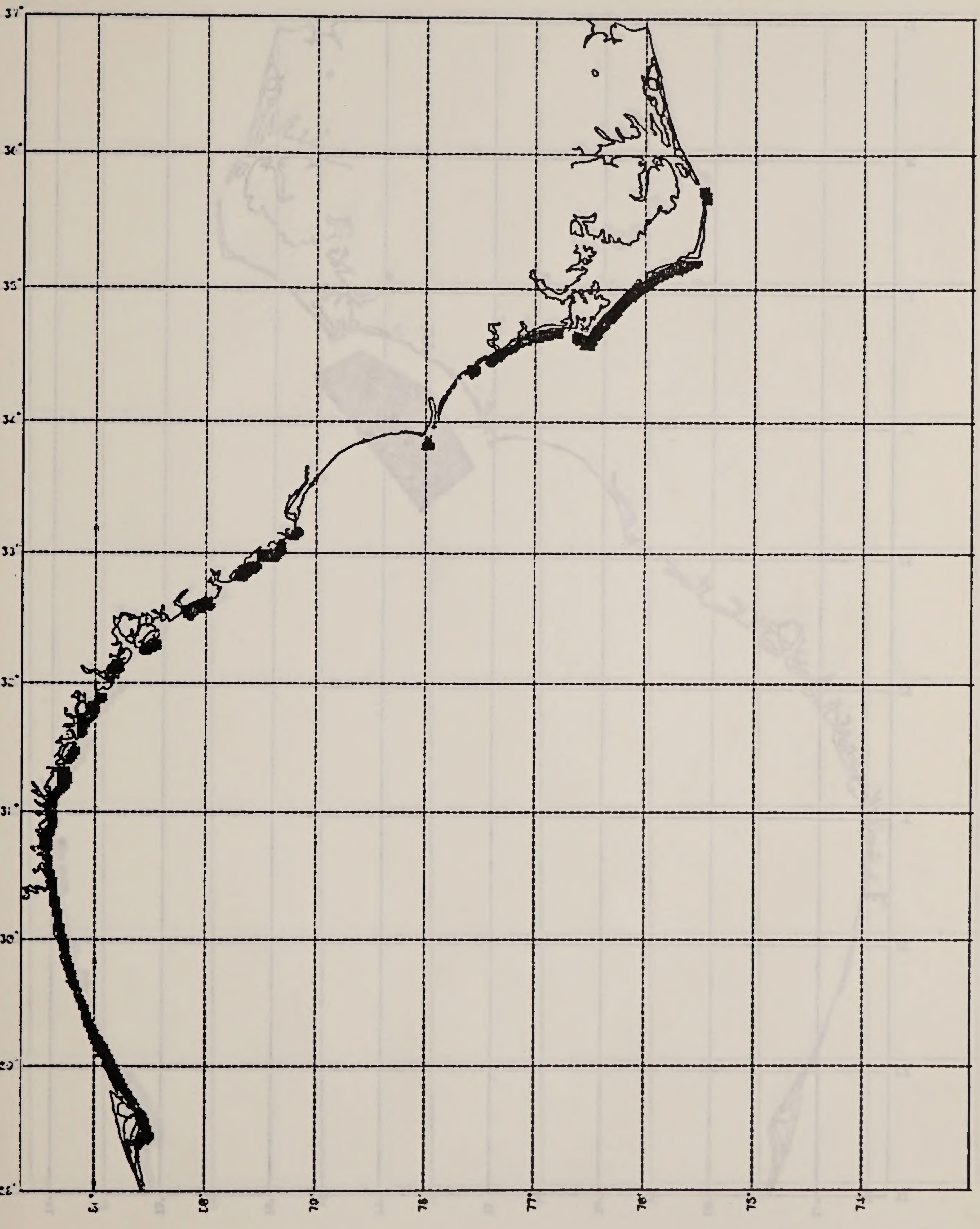

Figure A.2.--Map showing the location of marine turtle nesting habitat, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

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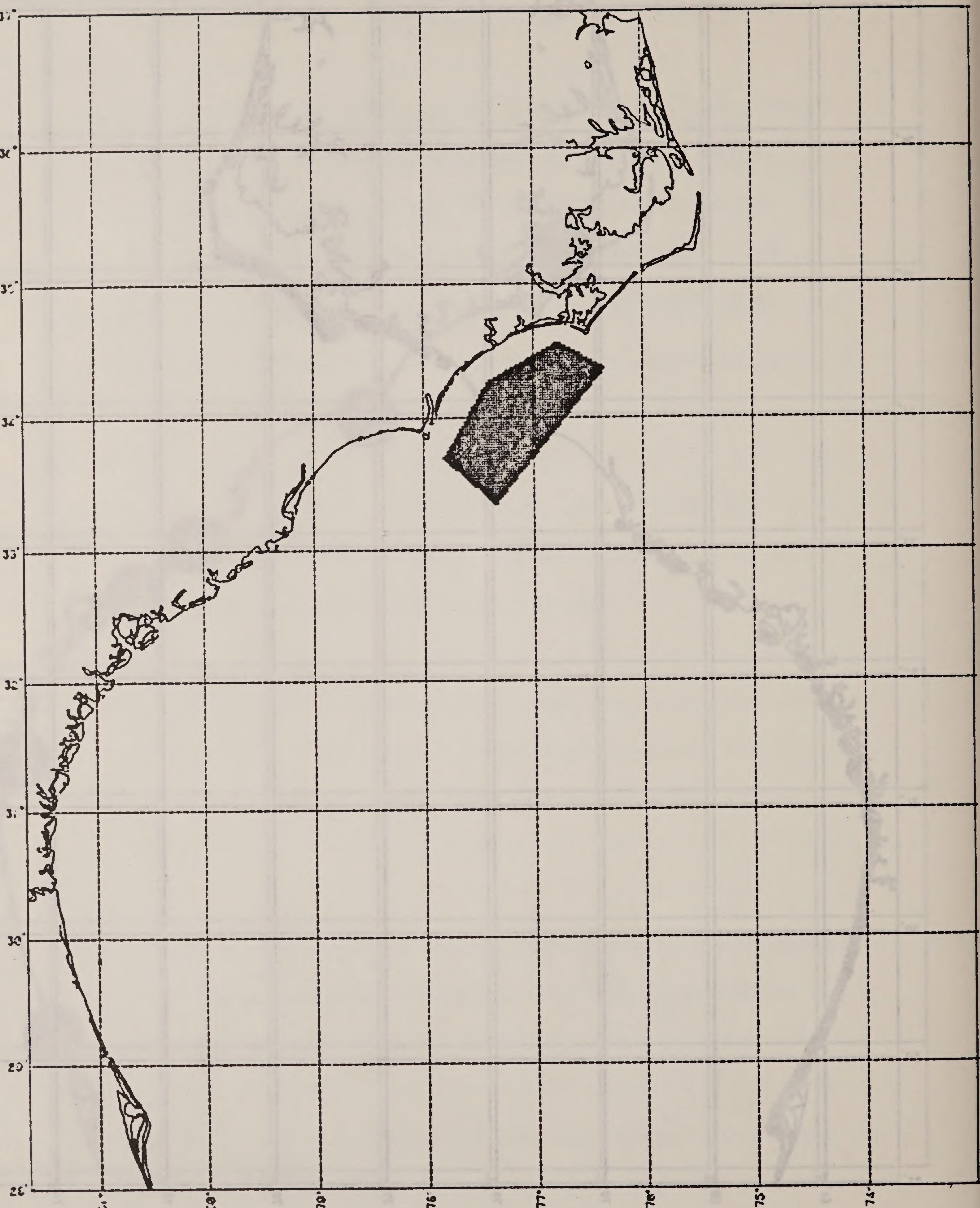

Figure A.3.--Map showing the location of Onslow Bay live bottom area, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

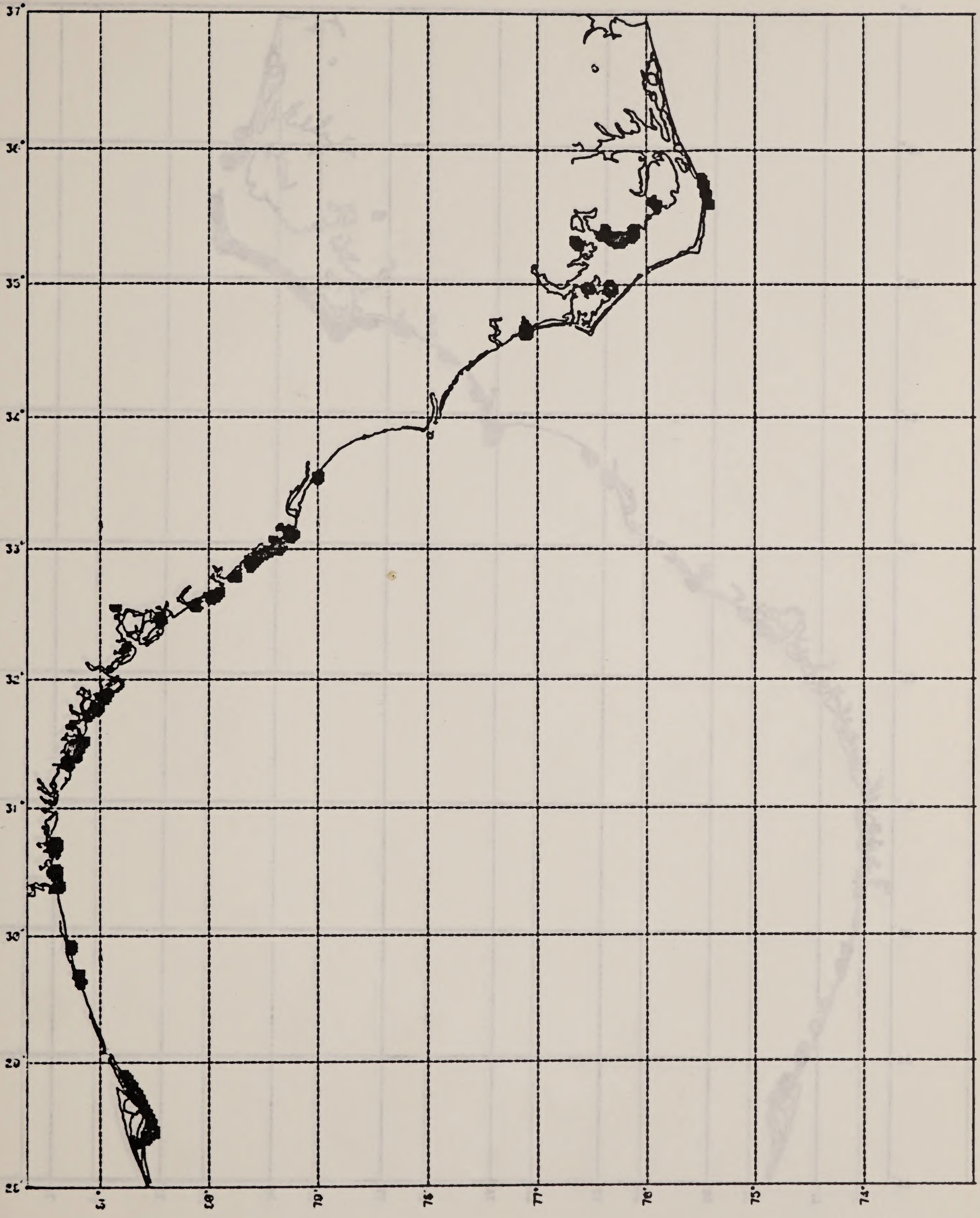

Figure A.4.--Map showing the location of Federal and State wildlife conservation areas, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

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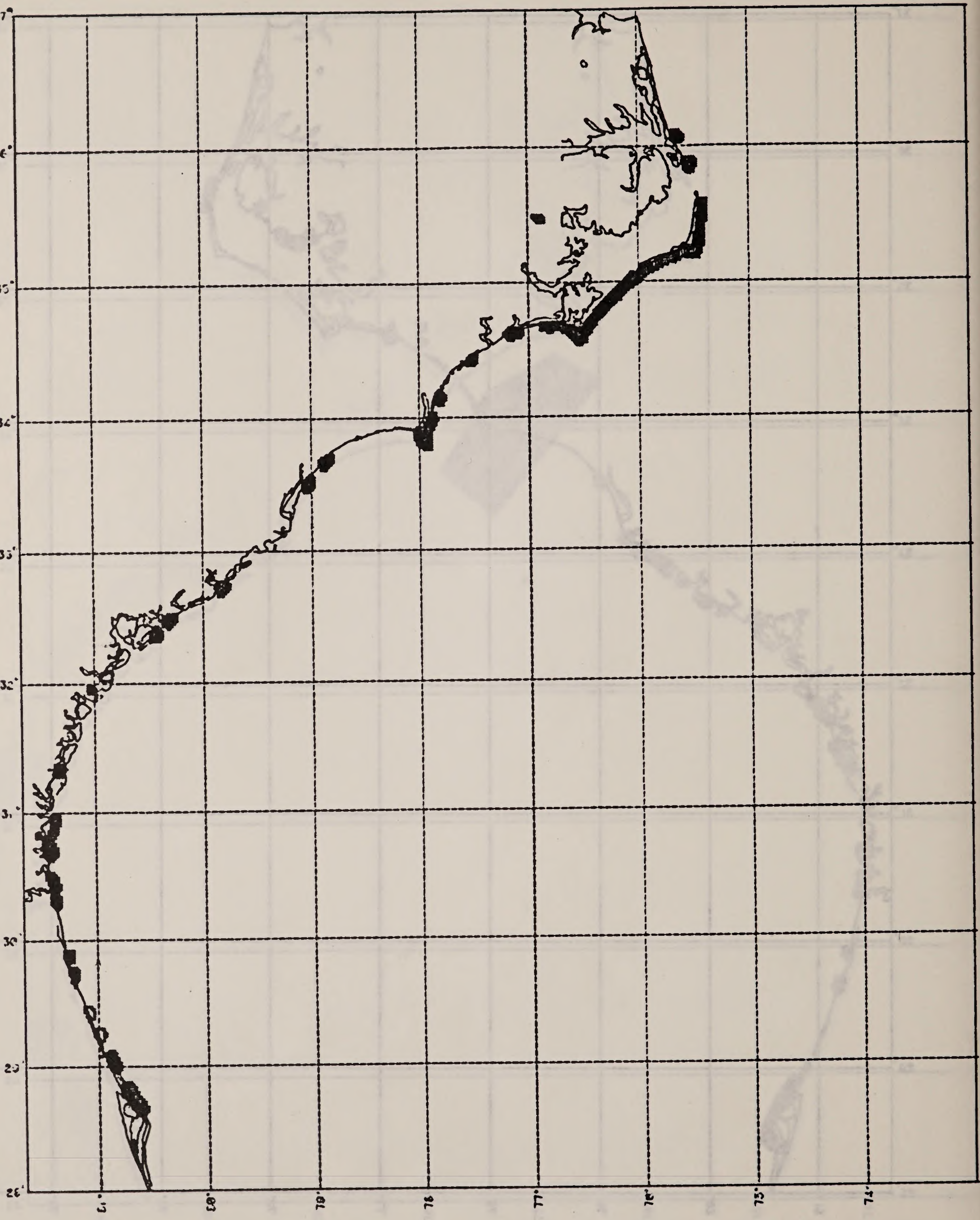

Figure A.5.--Map showing the location of Federal and State parks, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

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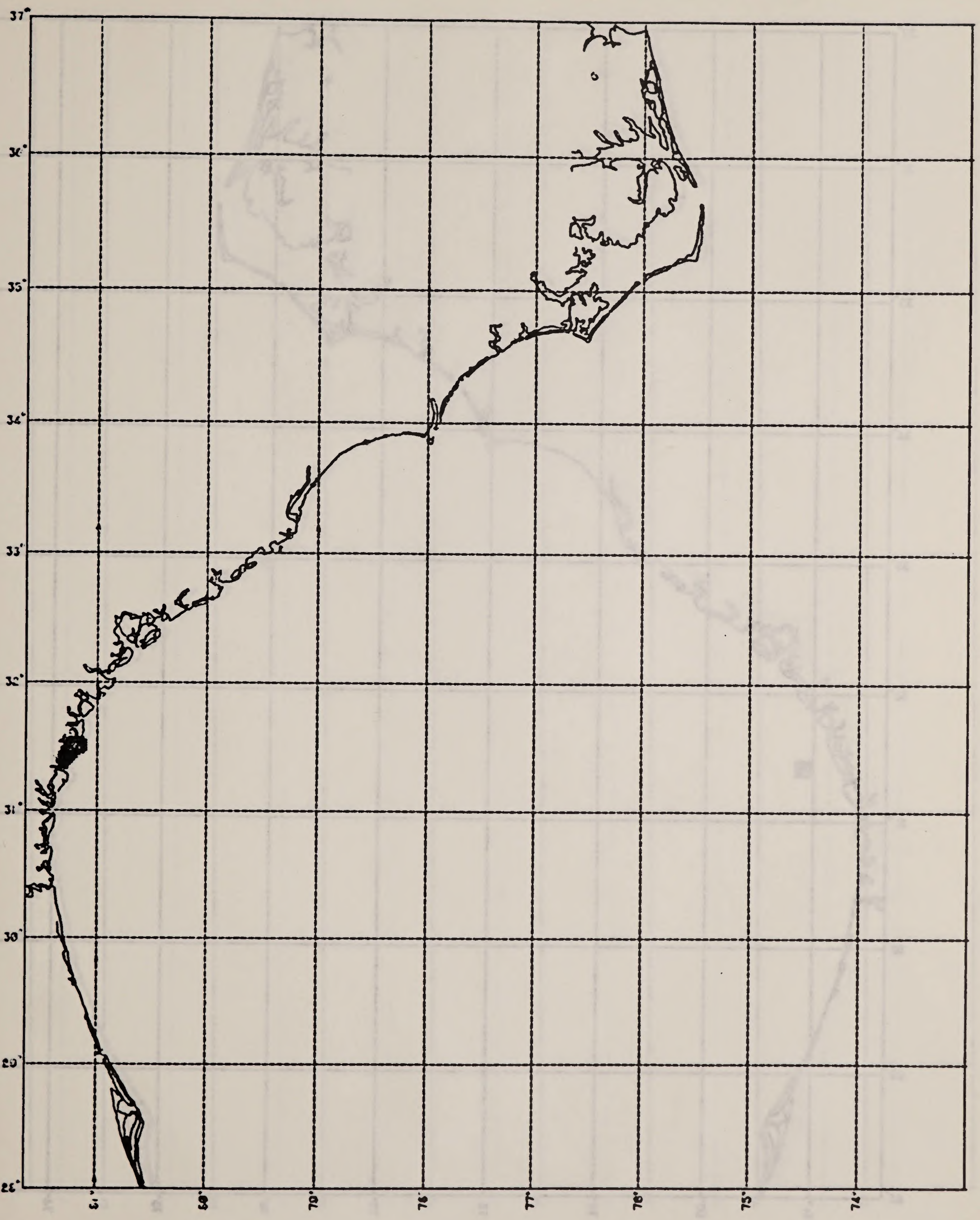

Figure A.6.--Map showing the location of Blackbeard Island, Sapelo Island, and Wolf Island, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

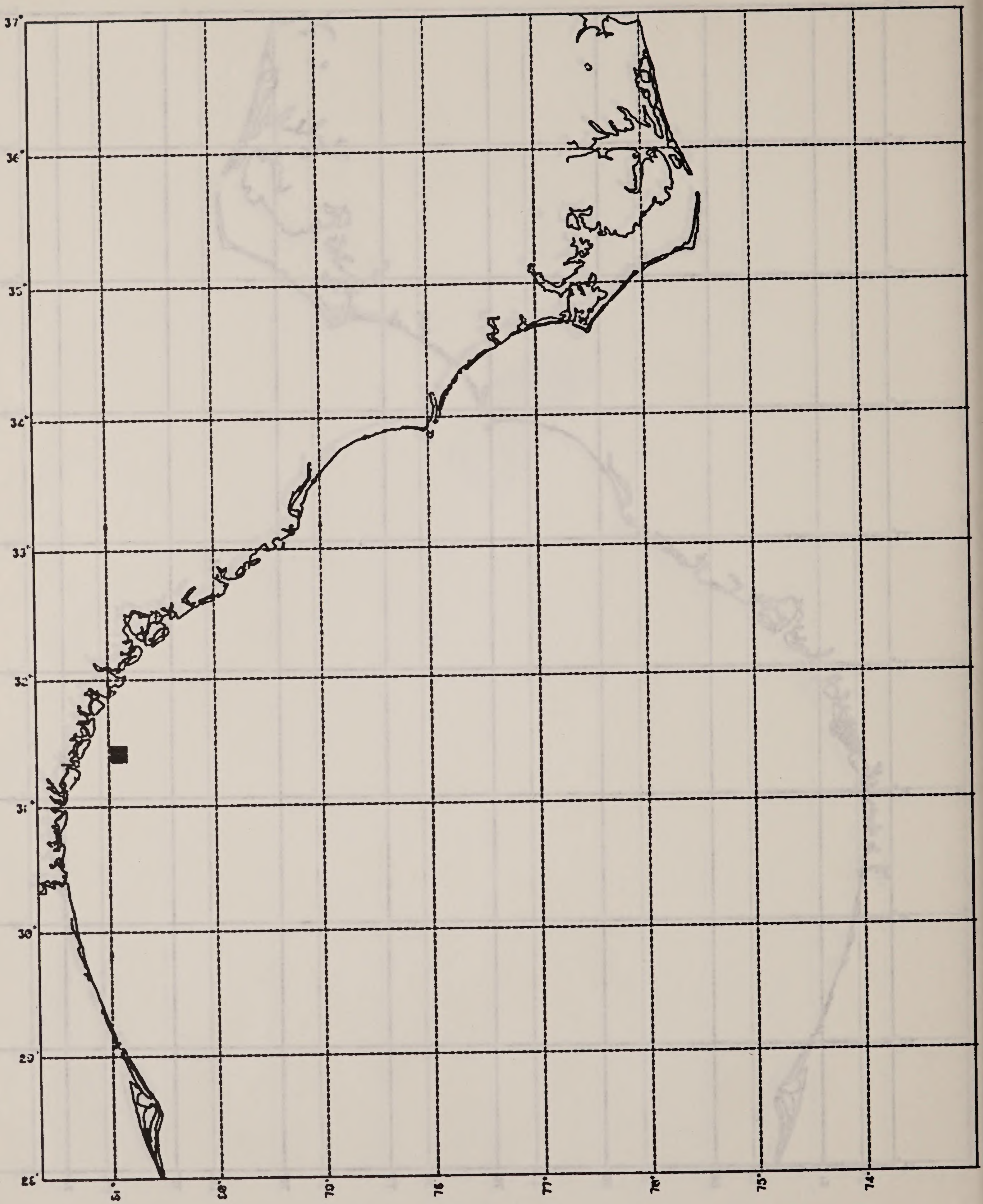

Figure A.7.--Map showing the location of Grays Reef, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

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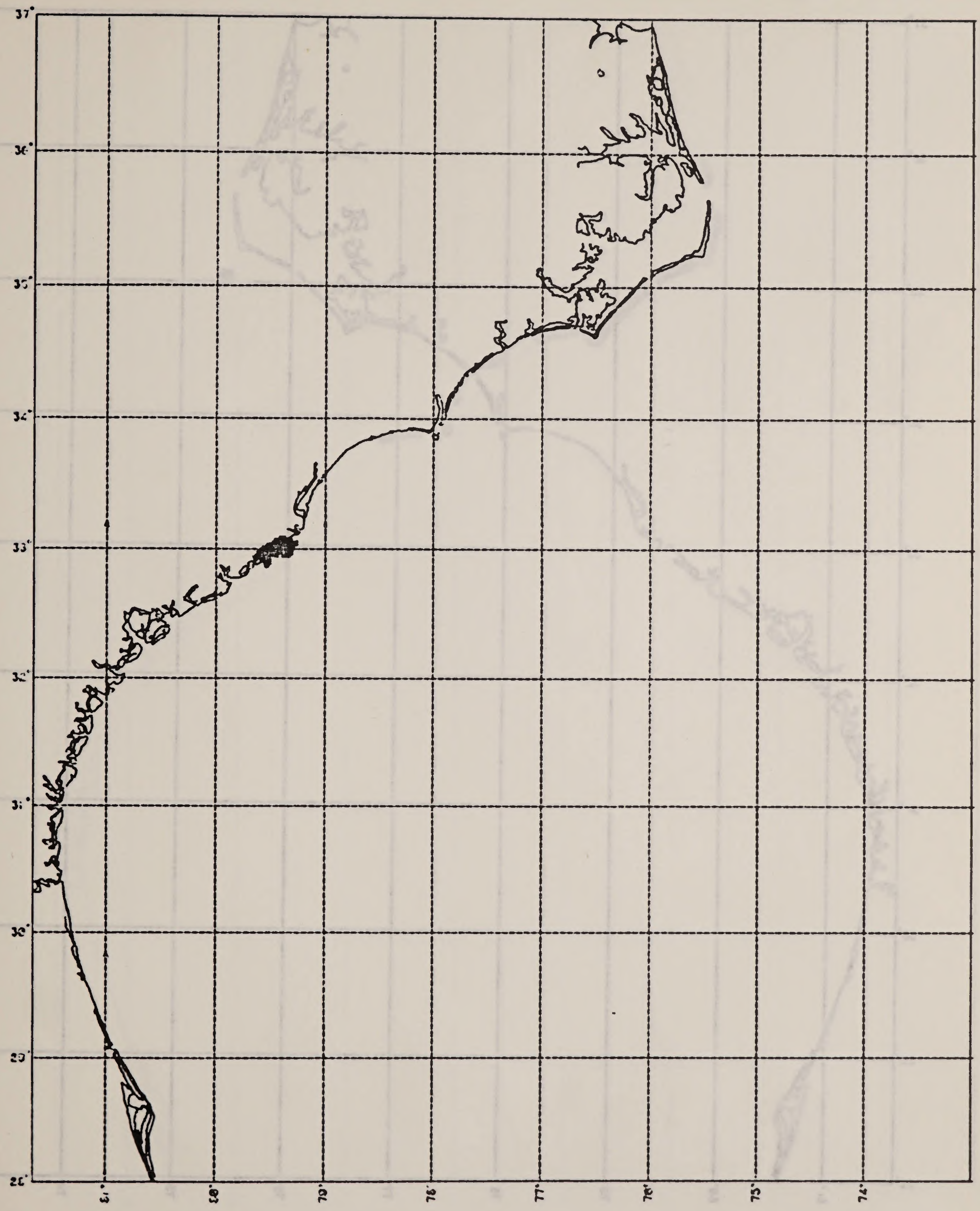

Figure A.8.--Map showing the location of Cape Romain national wilderness area, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

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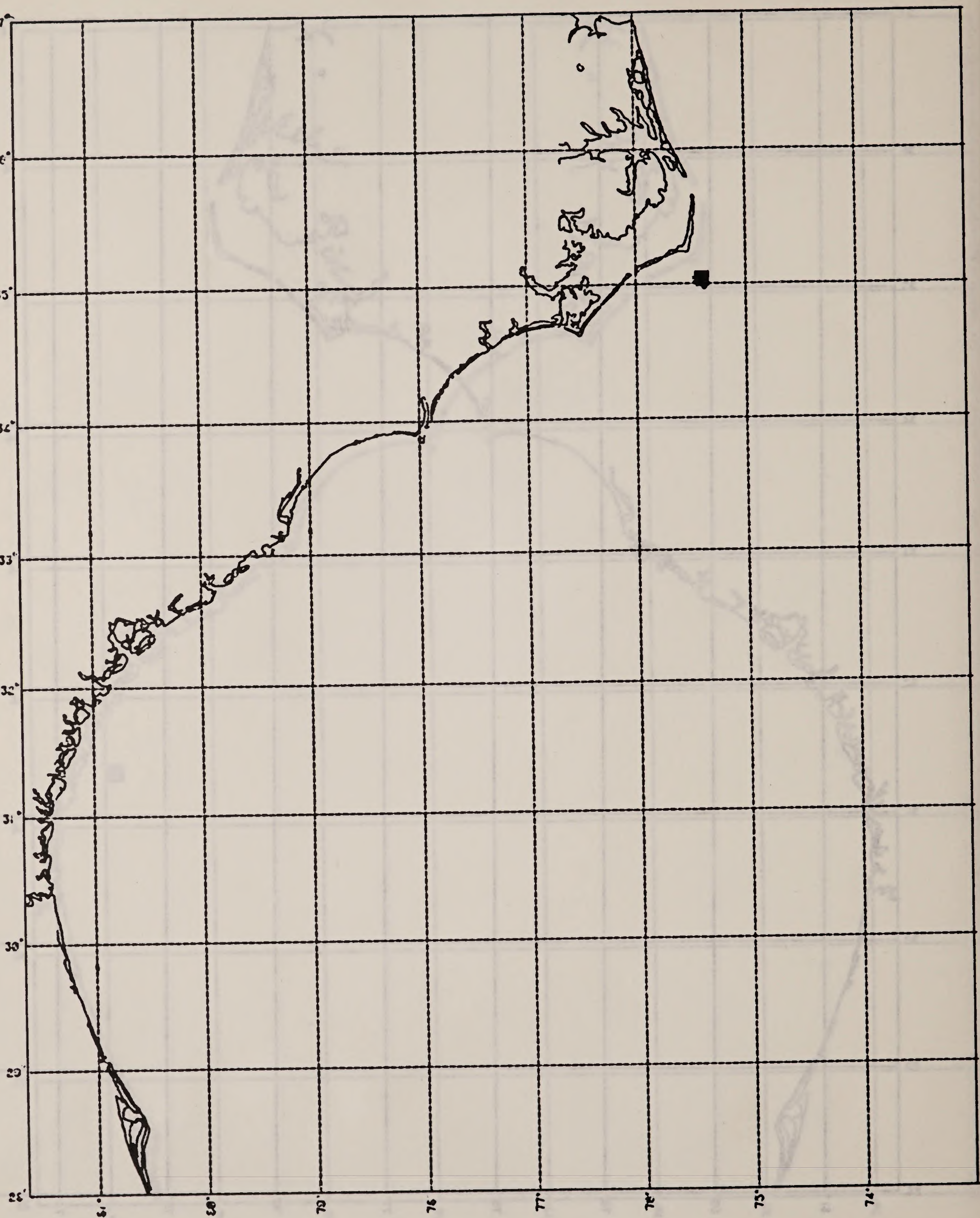

Figure A.9.--Map showing the location of Monitor marine sanctuary, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

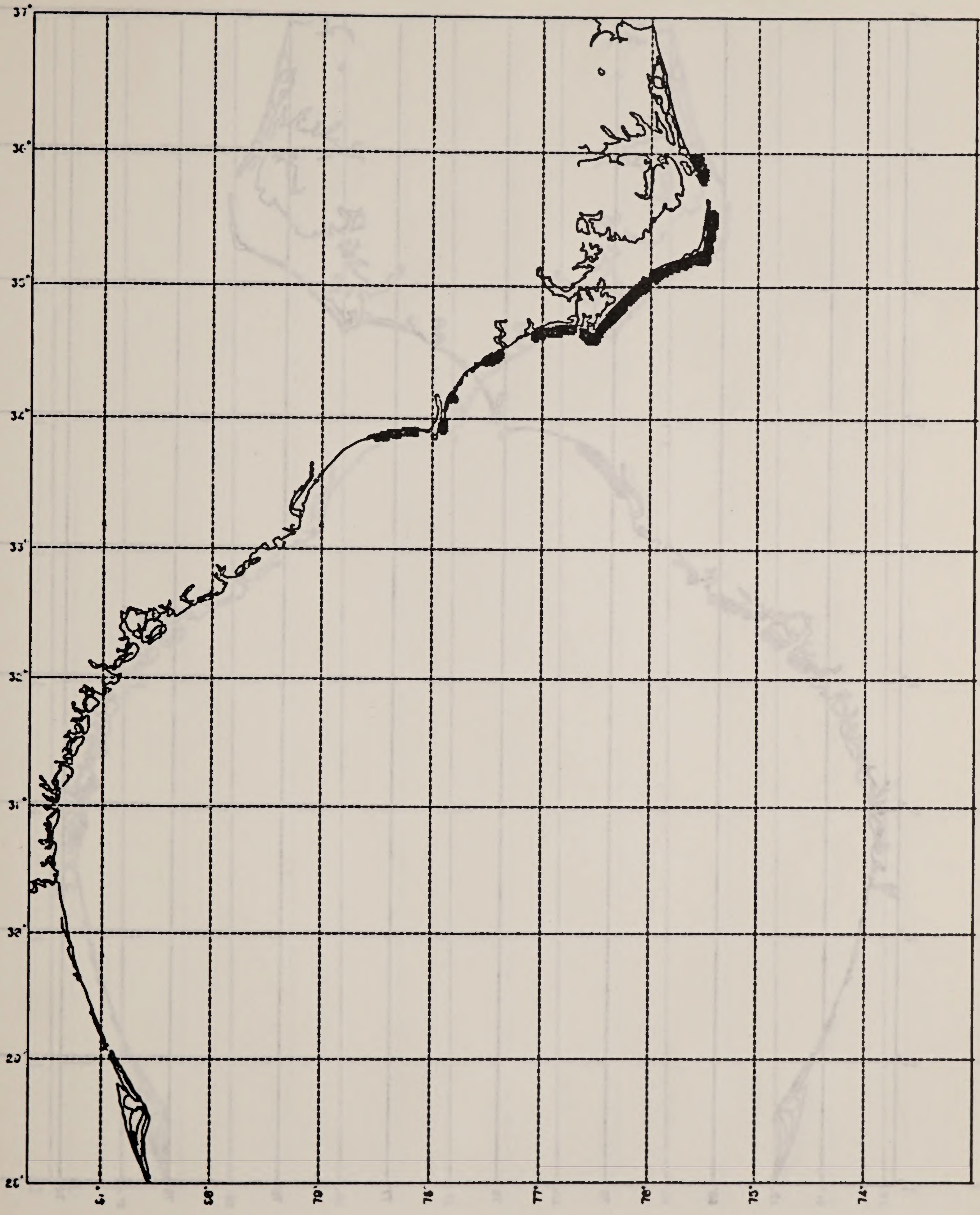

Figure A.10.--Map showing the location of tourist beaches-North Carolina, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

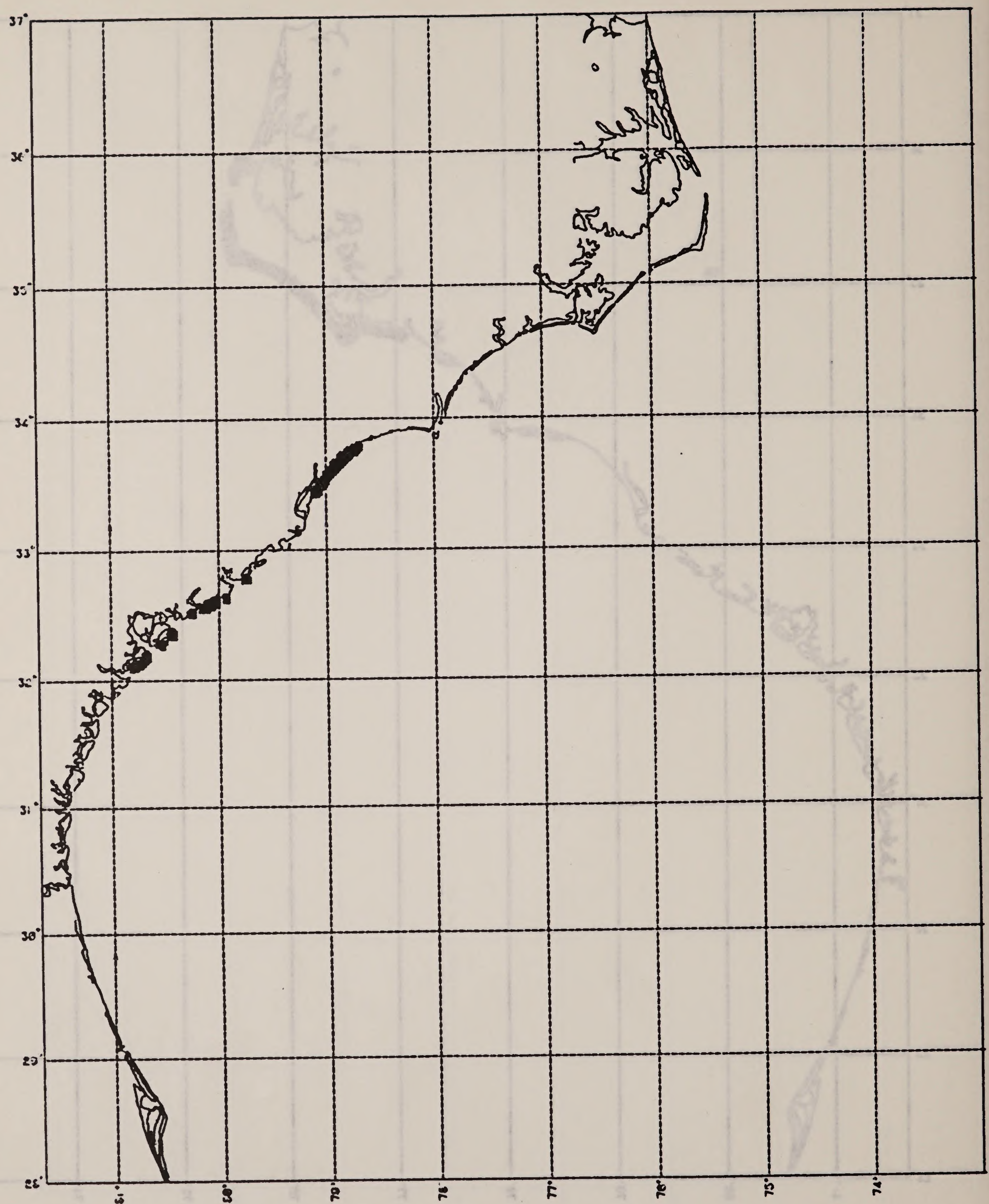

Figure A.11.--Map showing the location of tourist beaches-South Carolina, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

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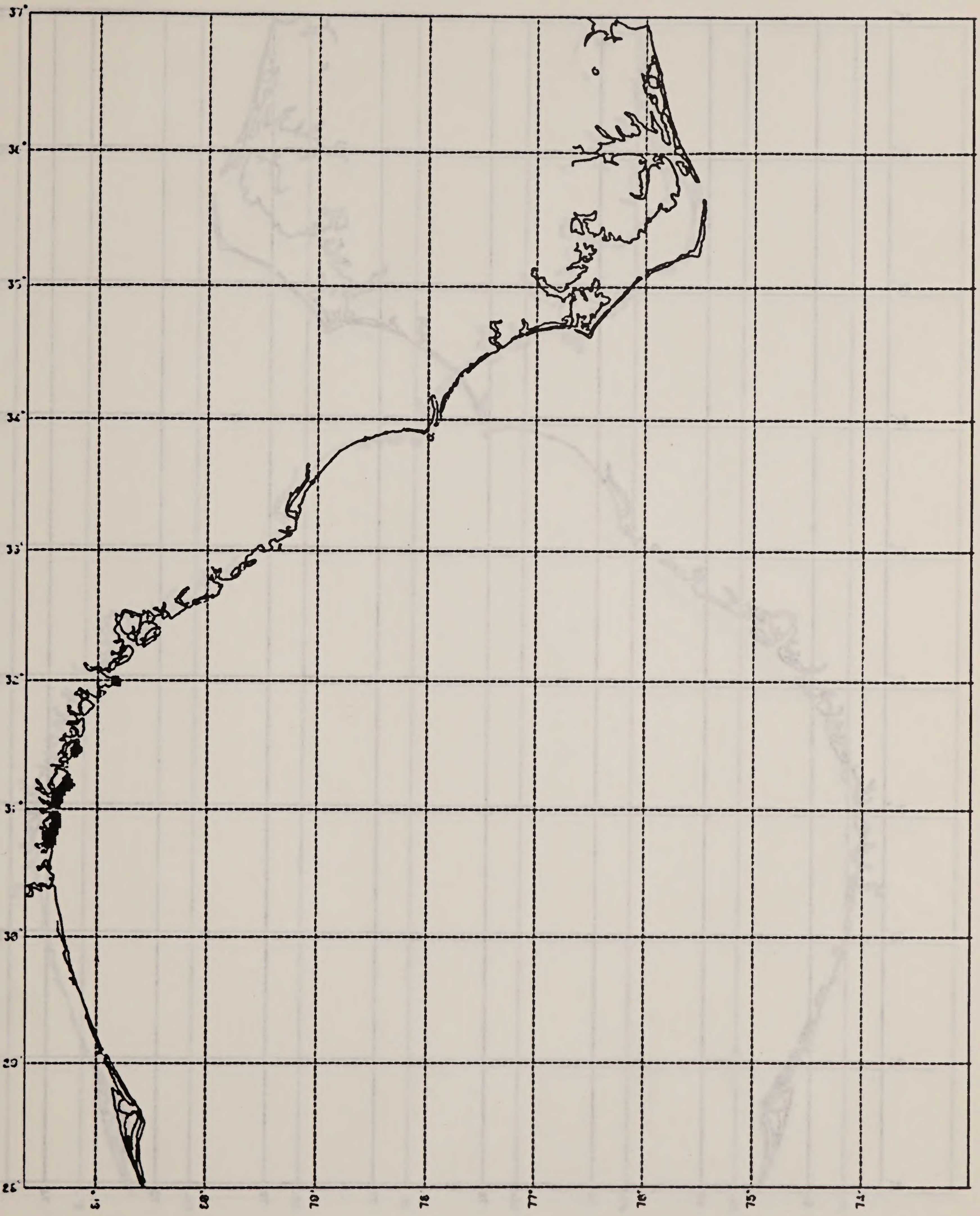


Figure A.12.--Map showing the location of tourist beaches-Georgia, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

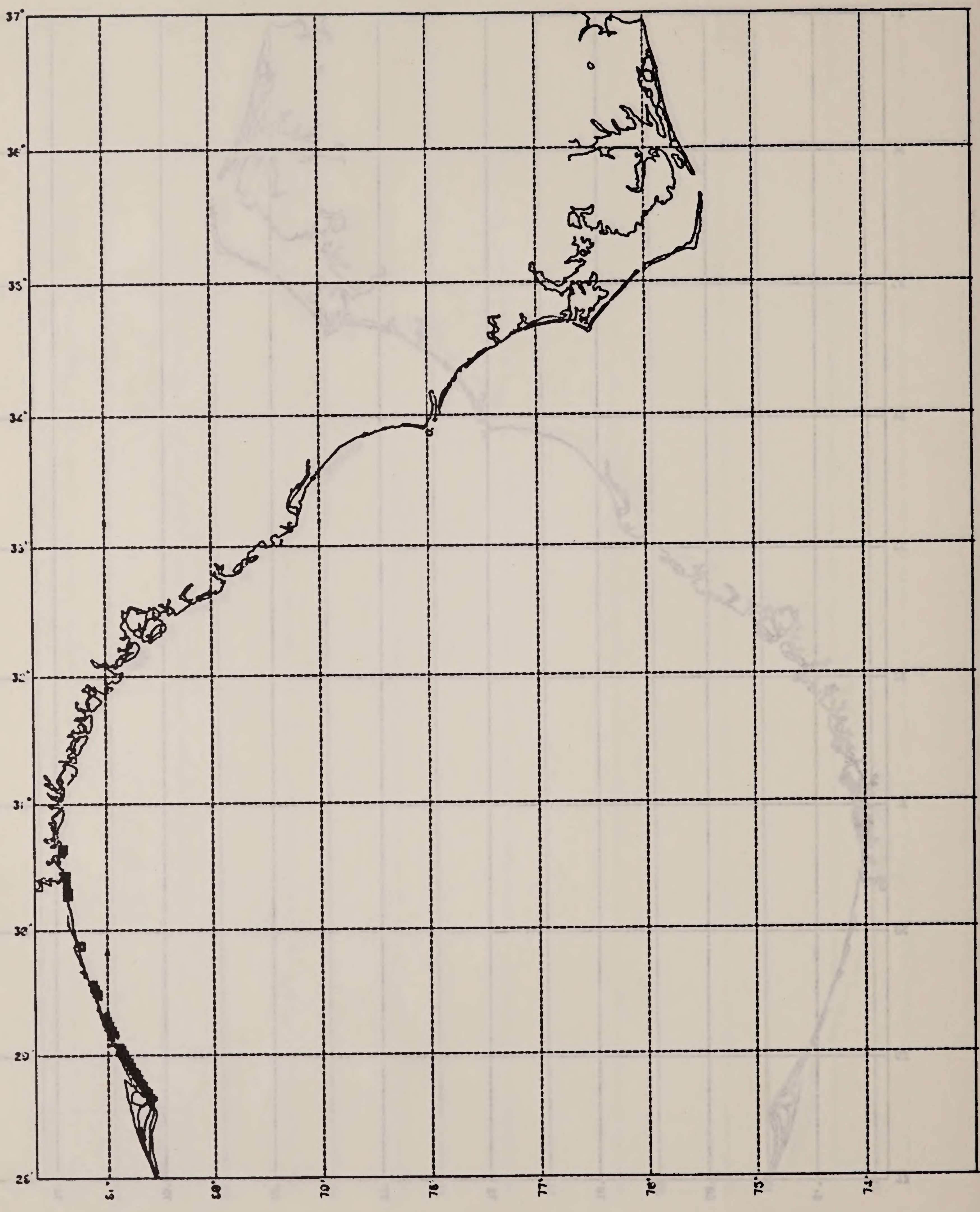


Figure A.13.--Map showing the location of tourist beaches-Florida, South Atlantic OCS Lease Sale 56; crosshatching indicates areal extent.

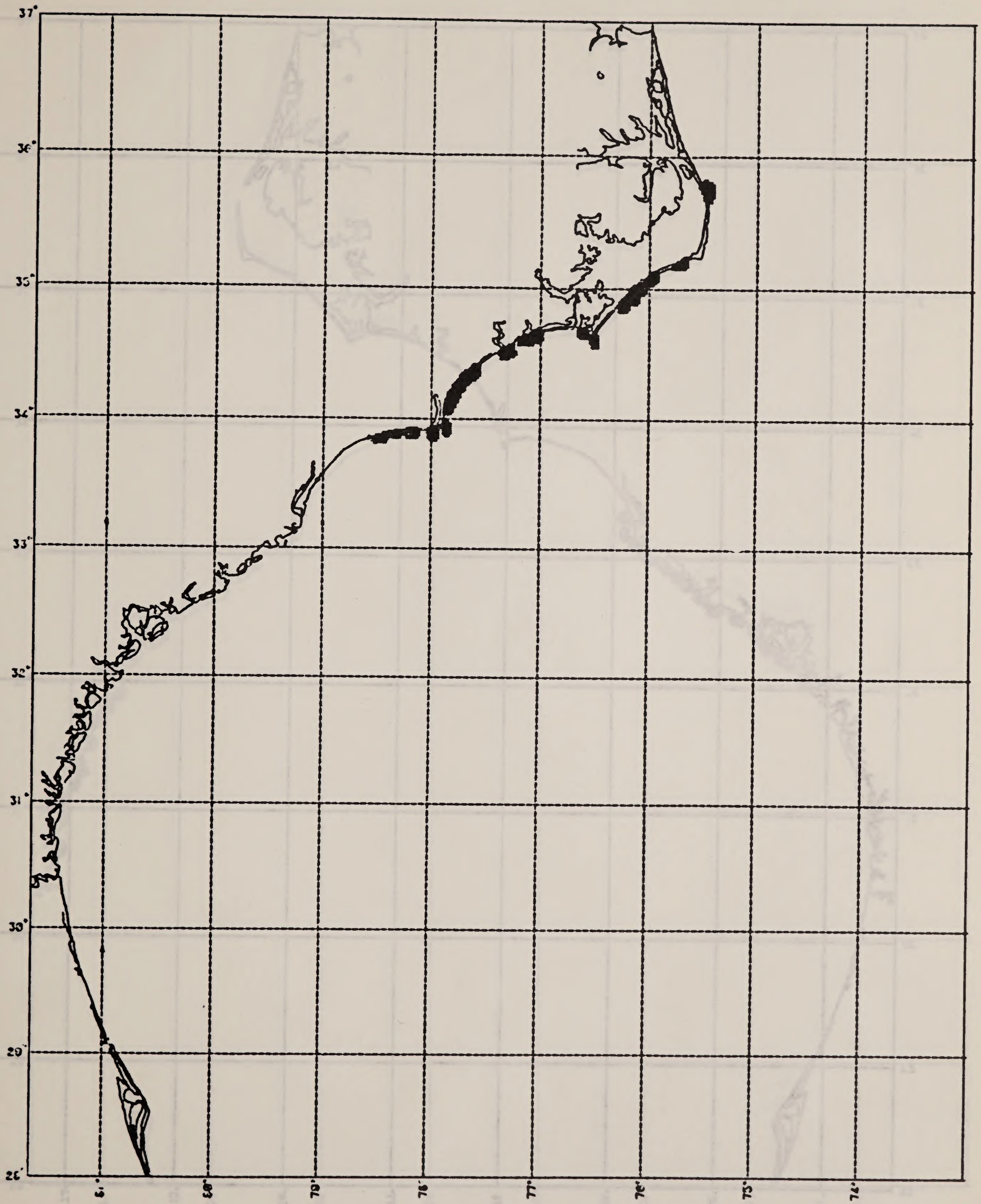


Figure A.14.--Map showing the location of coastal inlets-North Carolina, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

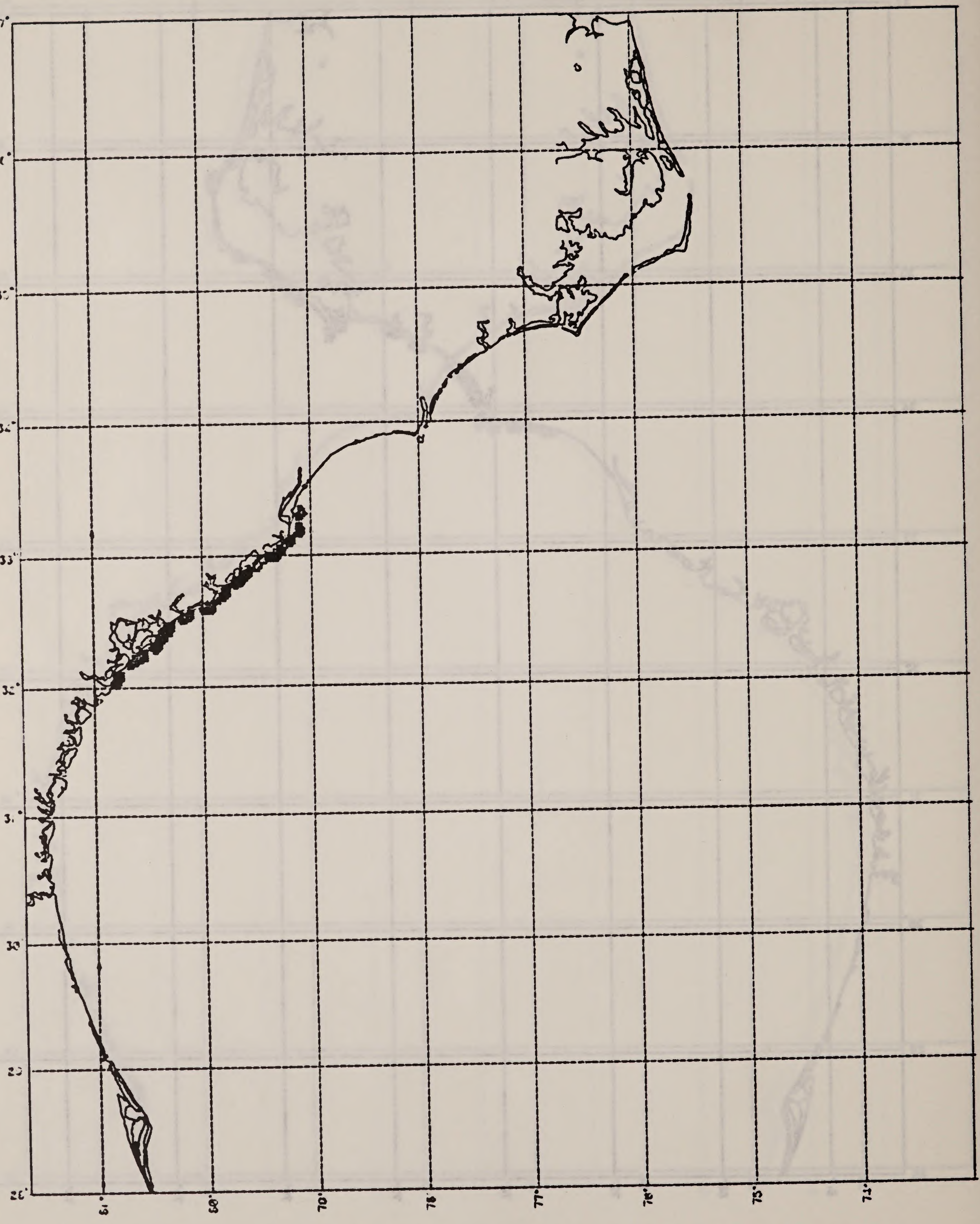


Figure A.15.--Map showing the location of coastal inlets-South Carolina, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

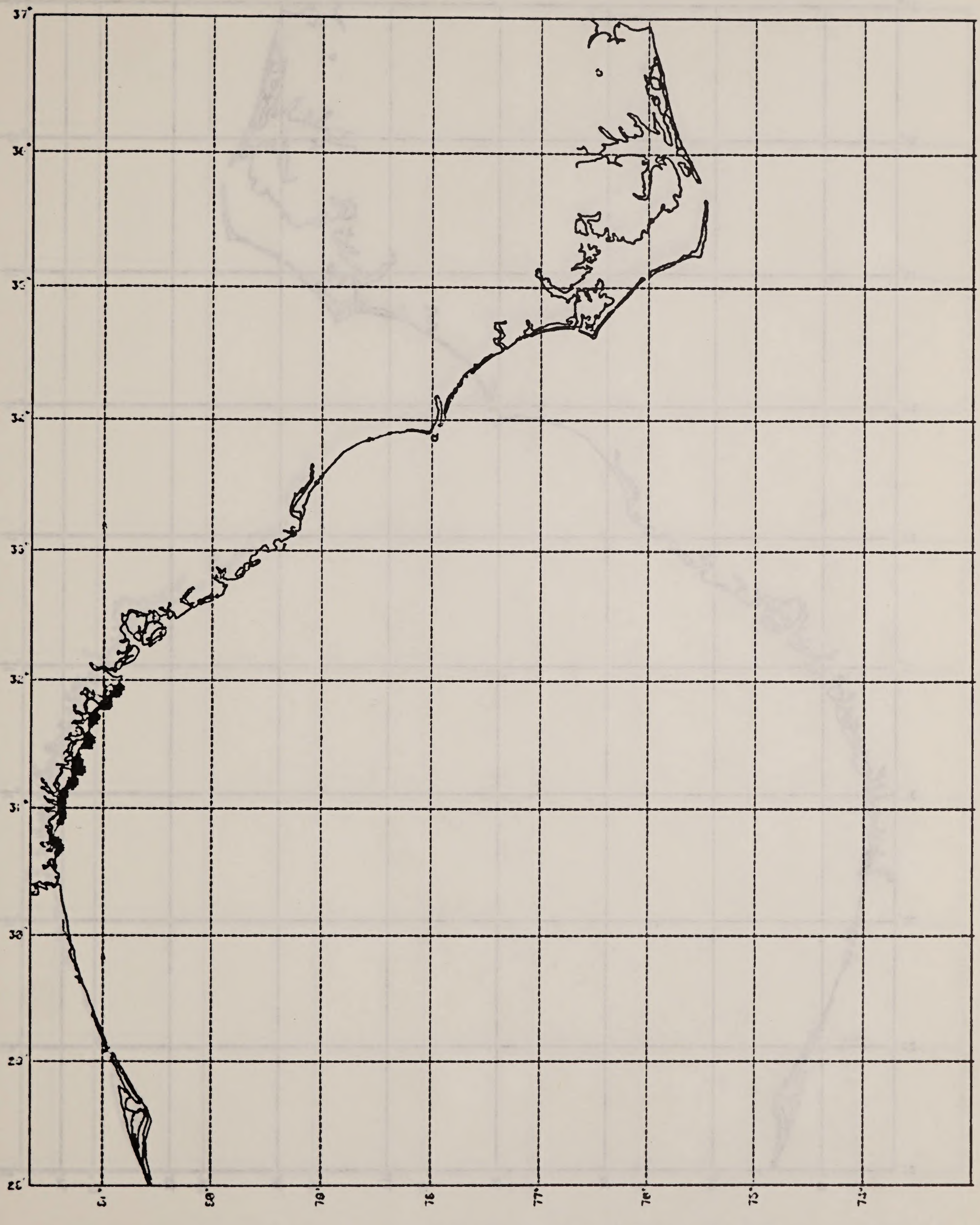


Figure A.16.--Map showing the location of coastal inlets-Georgia, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

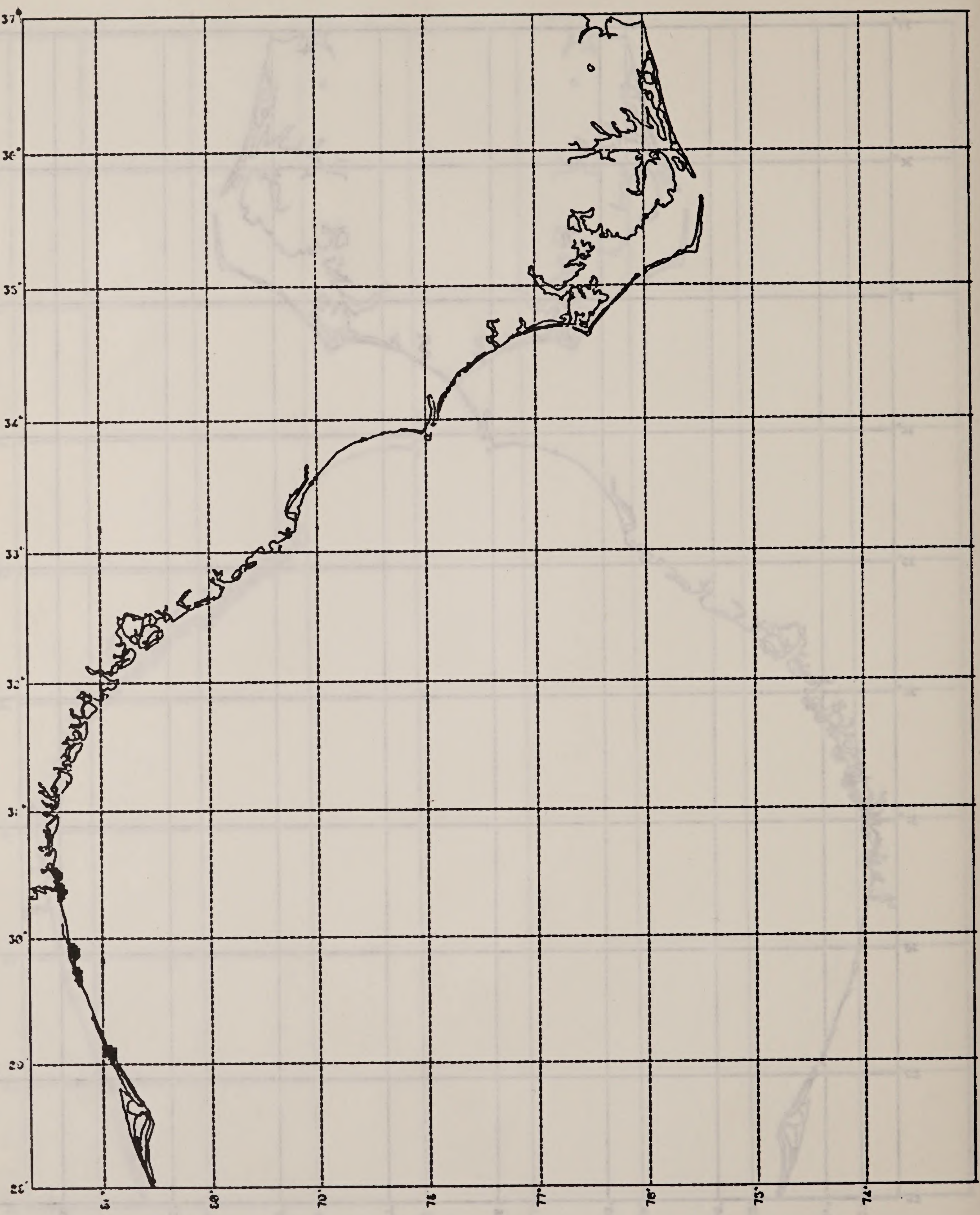


Figure A.17.--Map showing the location of coastal inlets-Florida, South Atlantic OCS Lease Sale 56; crosshatching indicates areal extent.

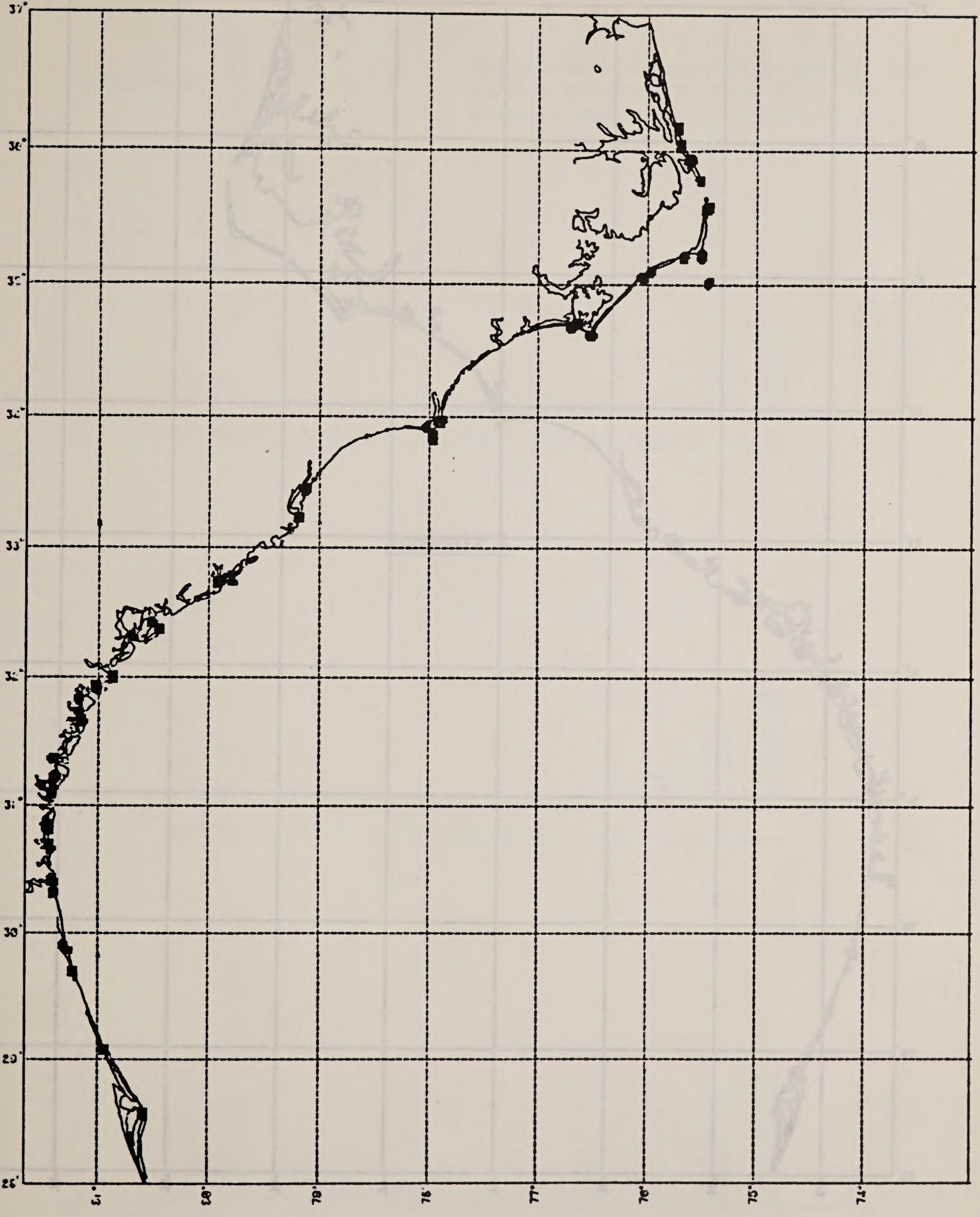


Figure A.18.--Map showing the location of historic sites, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

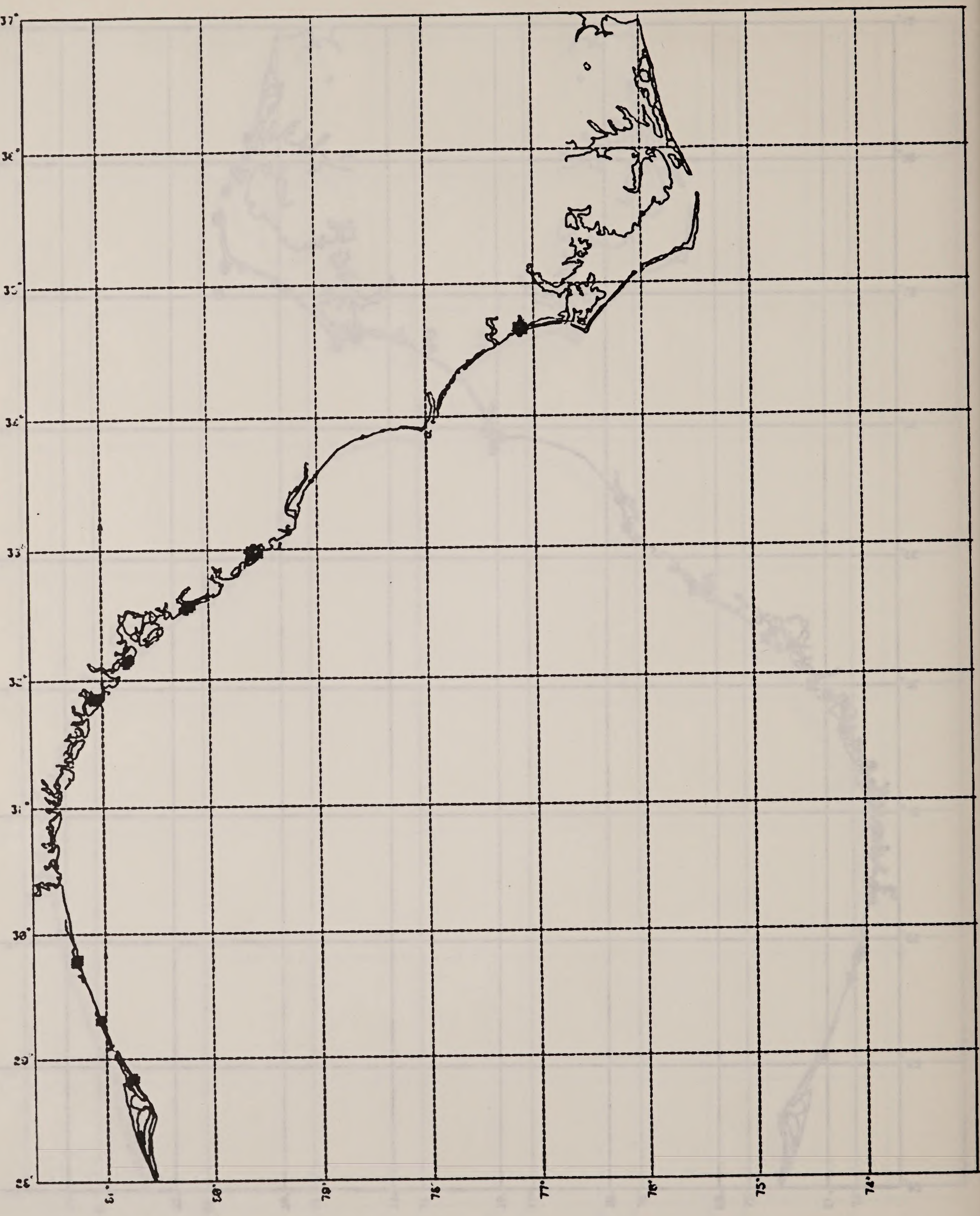
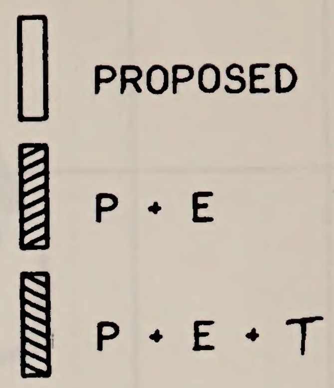


Figure A.19.--Map showing the location of prehistoric sites, South Atlantic OCS Lease Sale 56: crosshatching indicates areal extent.

Appendix B

Note: The histogram P&E (proposed plus existing tracts) and P&E&T (proposed plus existing tracts plus transportation) are reversed in Figures B-1 through B-9.



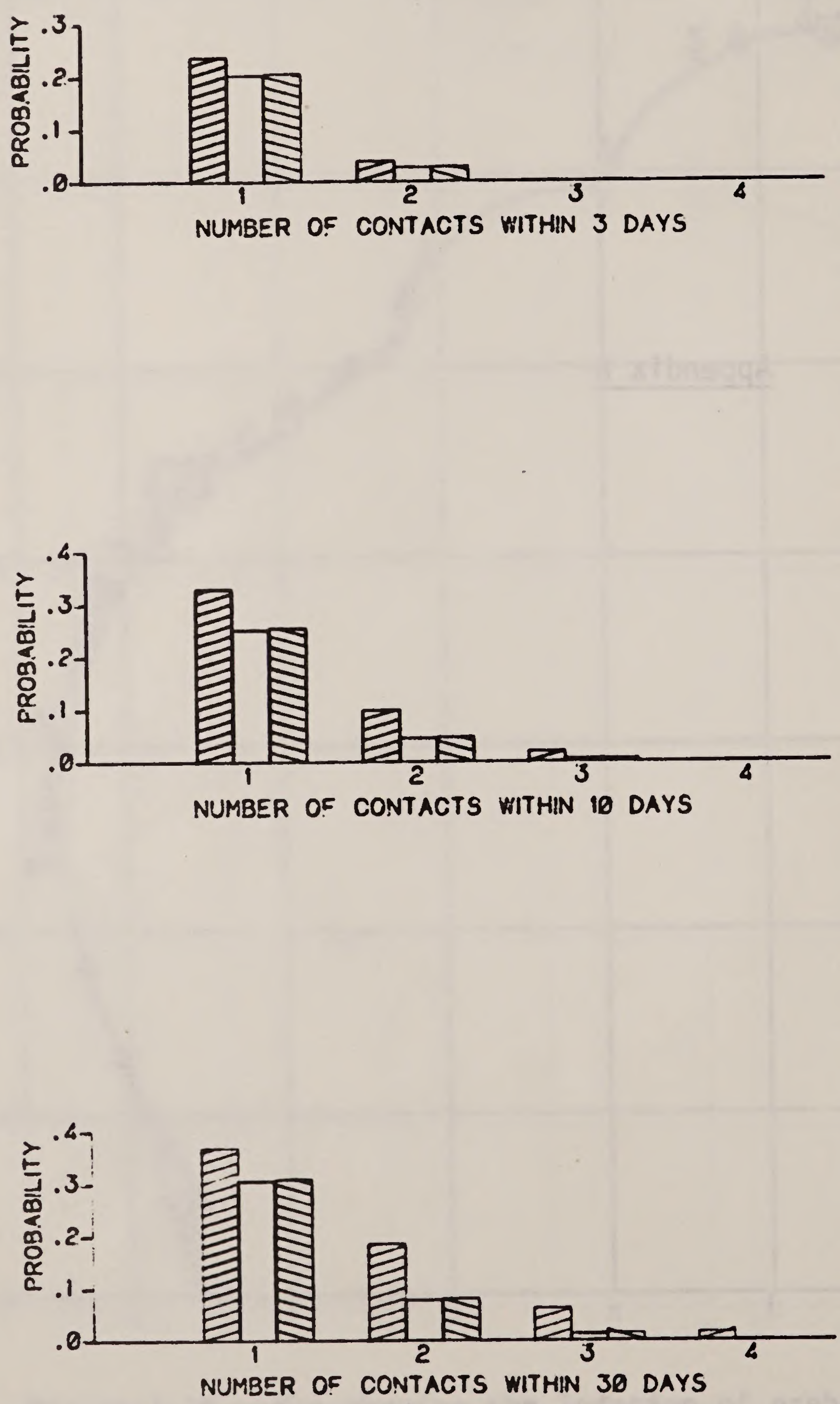


Figure B-1.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting brown pelican rookeries as as result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

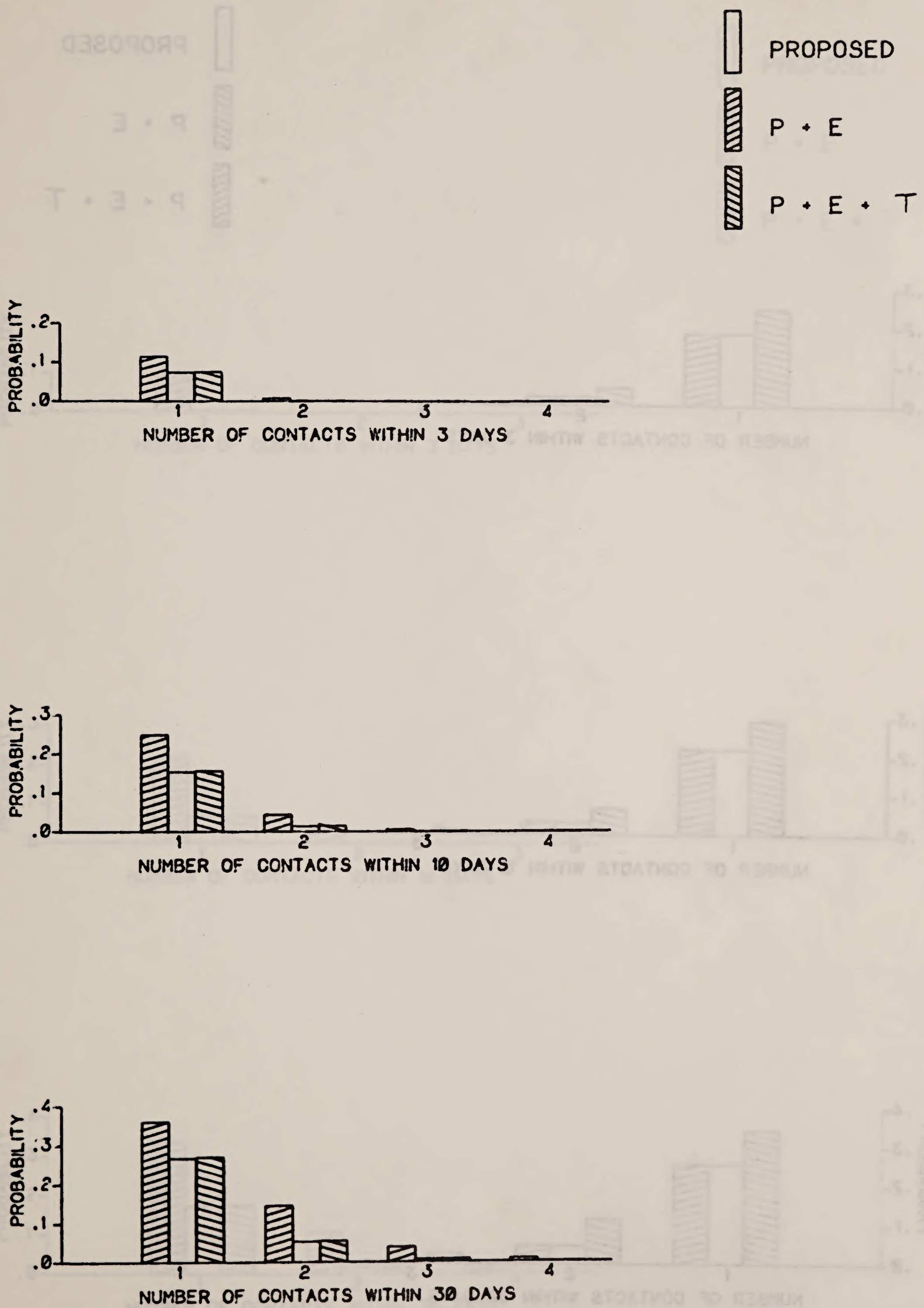


Figure B-2.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting marine turtle nesting habitat as a result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

DRAFT

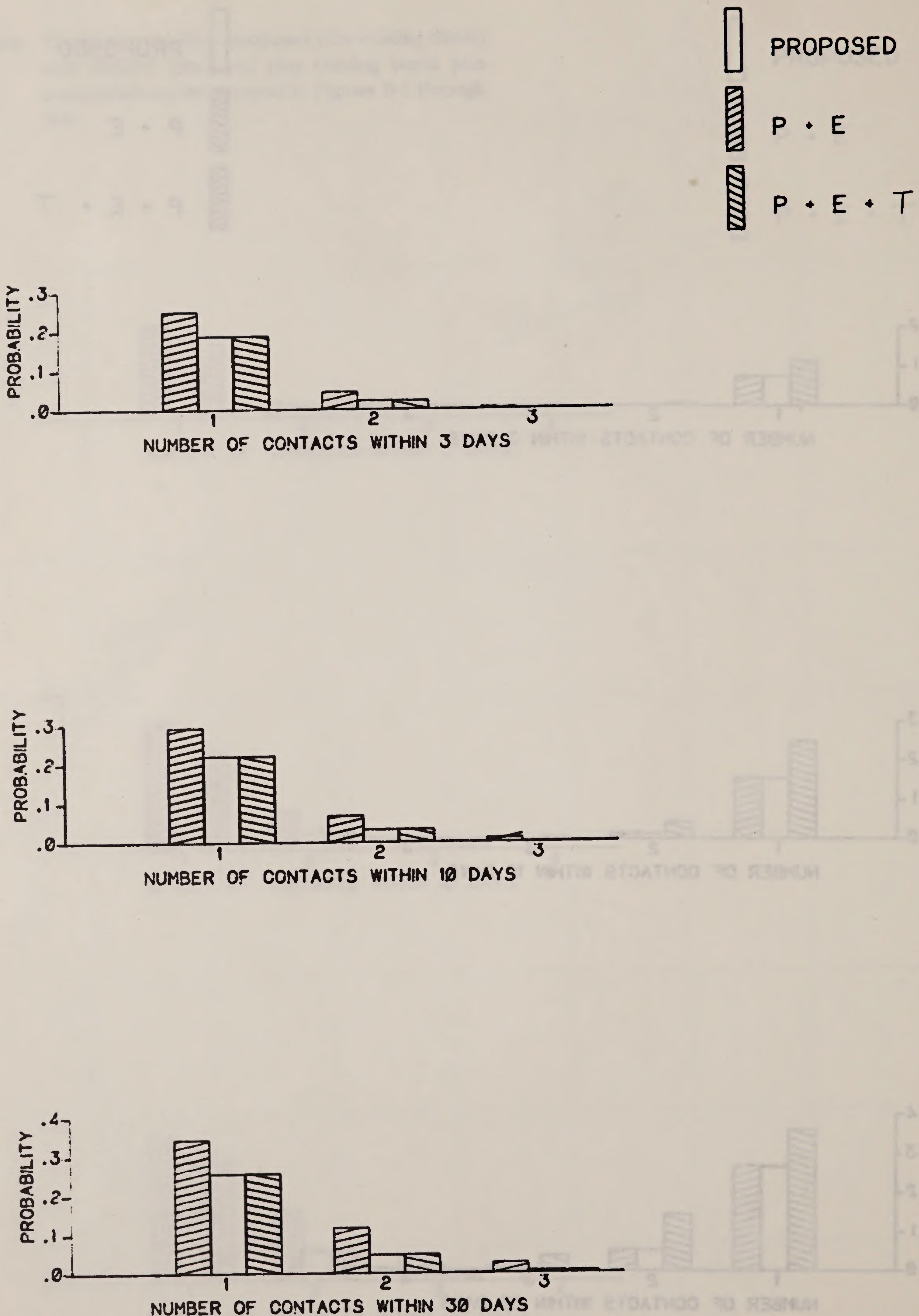


Figure B-3.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting the Onslow Bay live bottom area as a result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

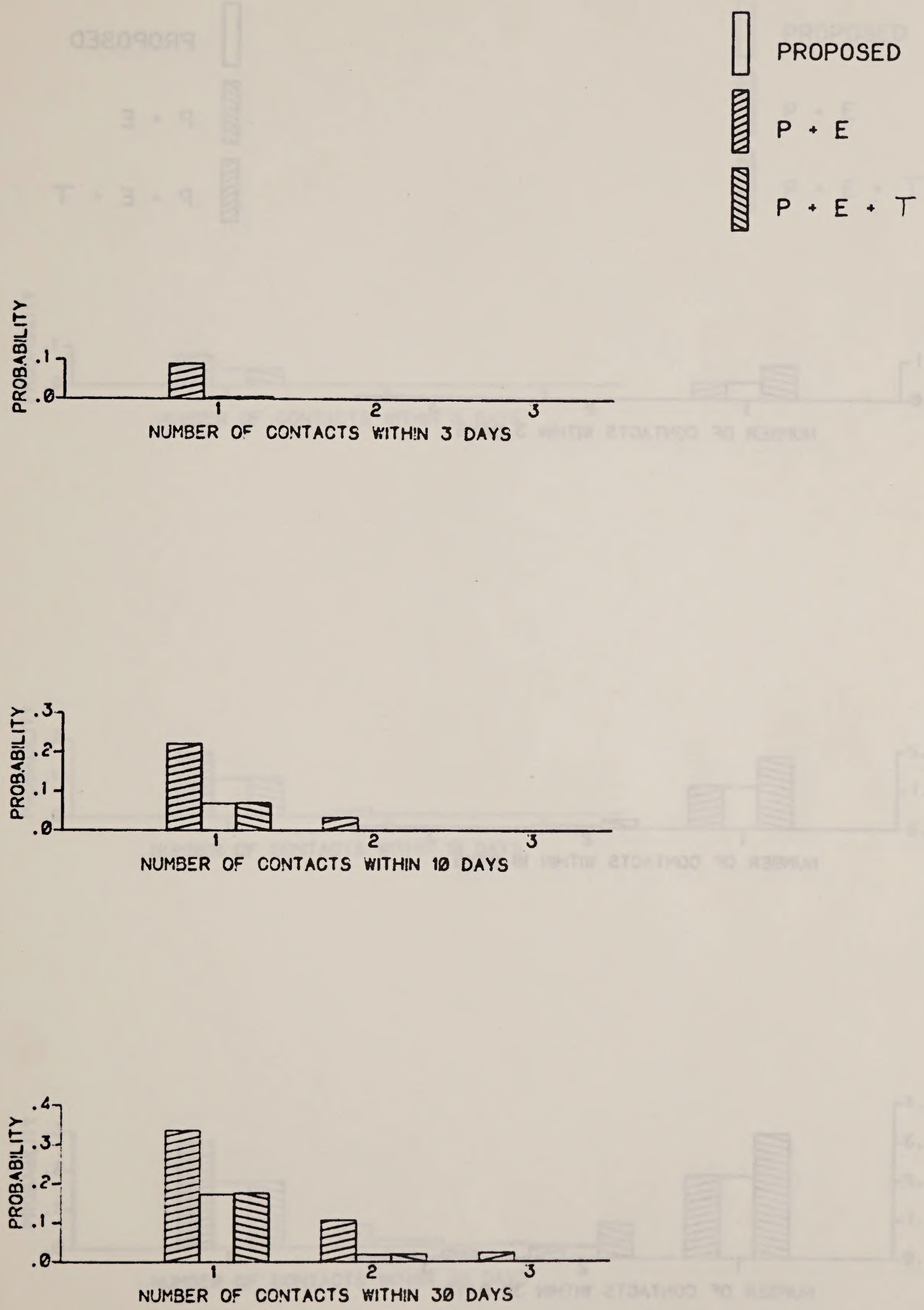


Figure B-4.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting Federal and State wildlife conservation areas as a result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

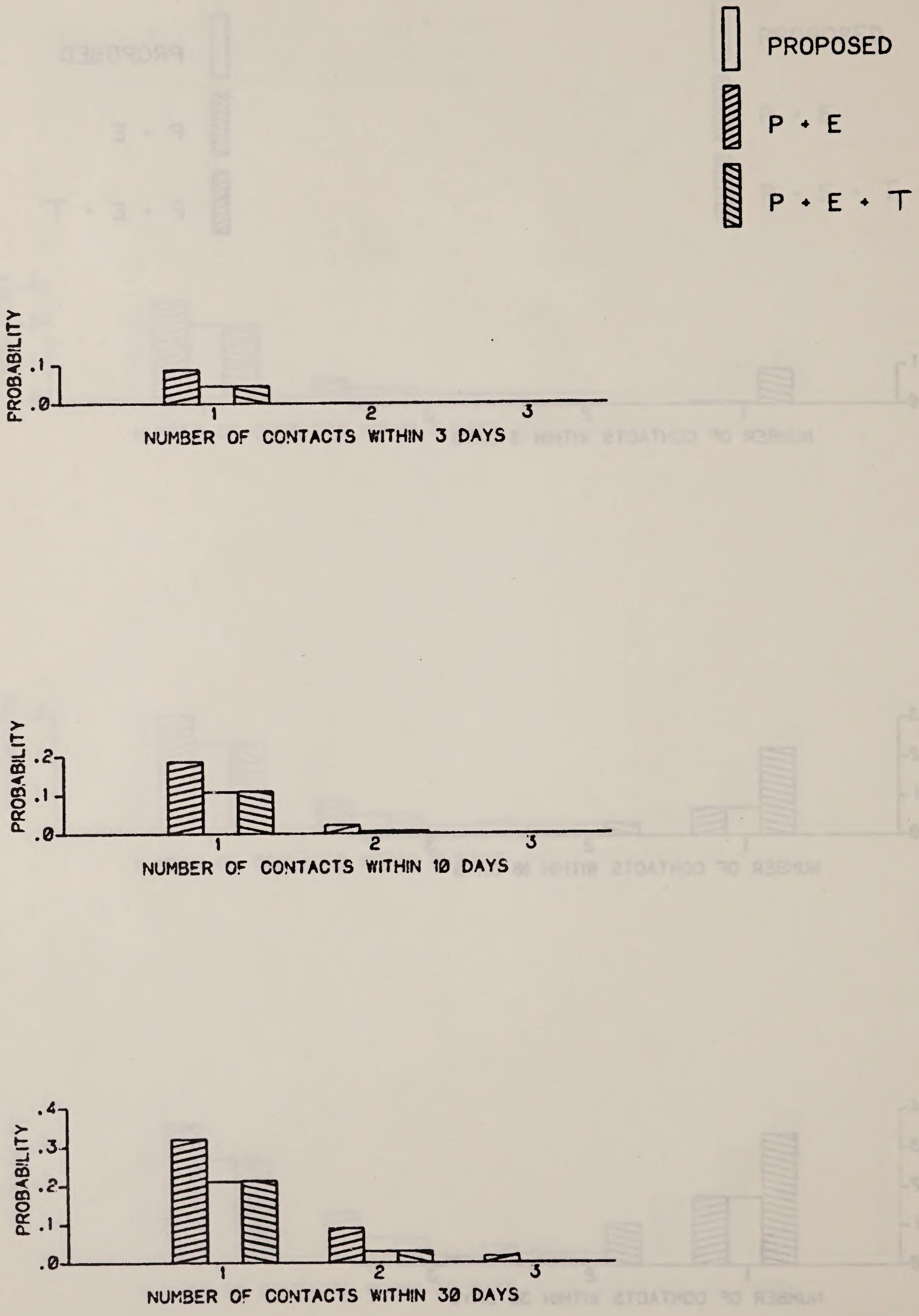


Figure B-5.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting Federal and State parks from May through October as a result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

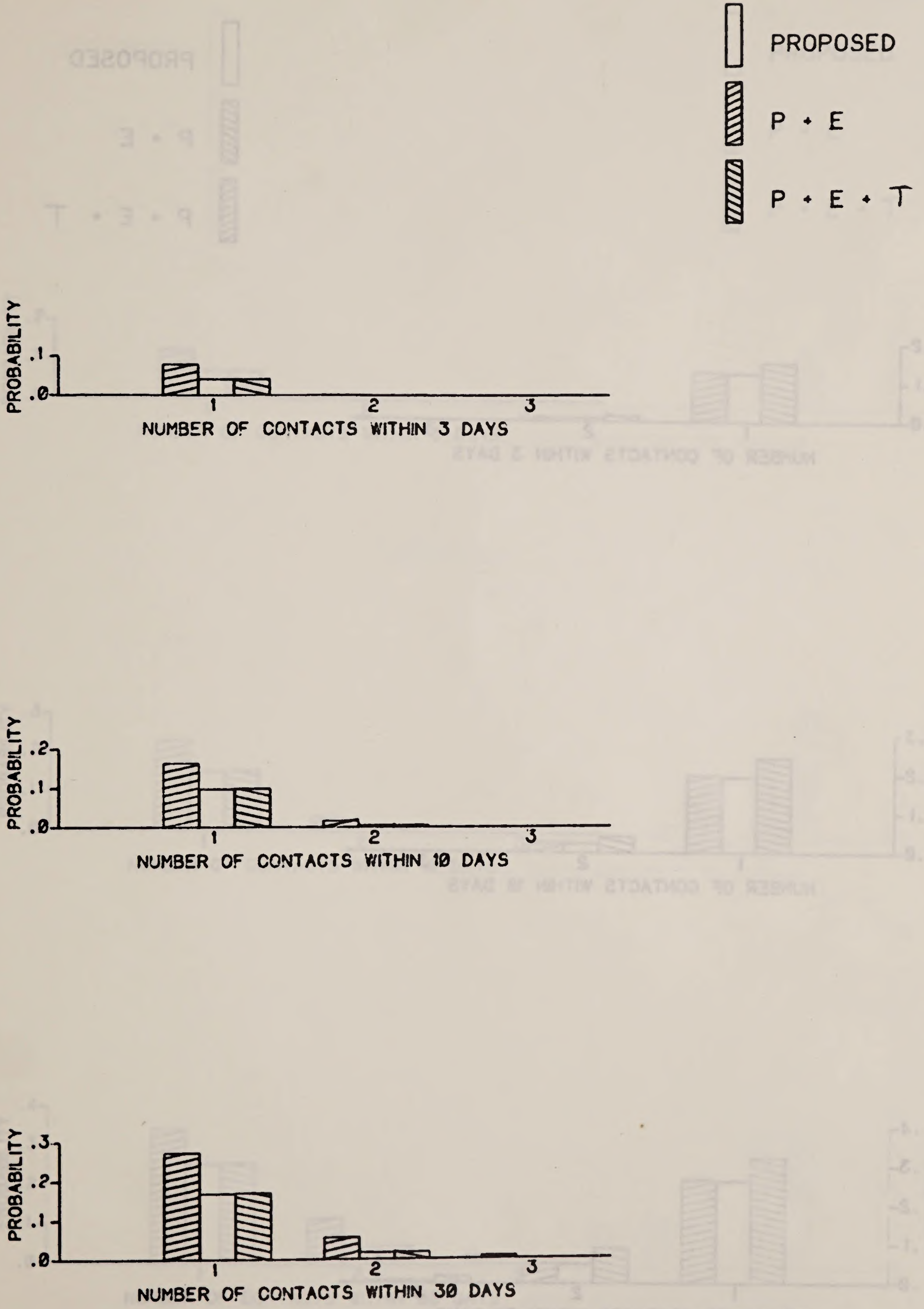


Figure B-6.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting Federal and State parks from November through April as a result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

DRAFT

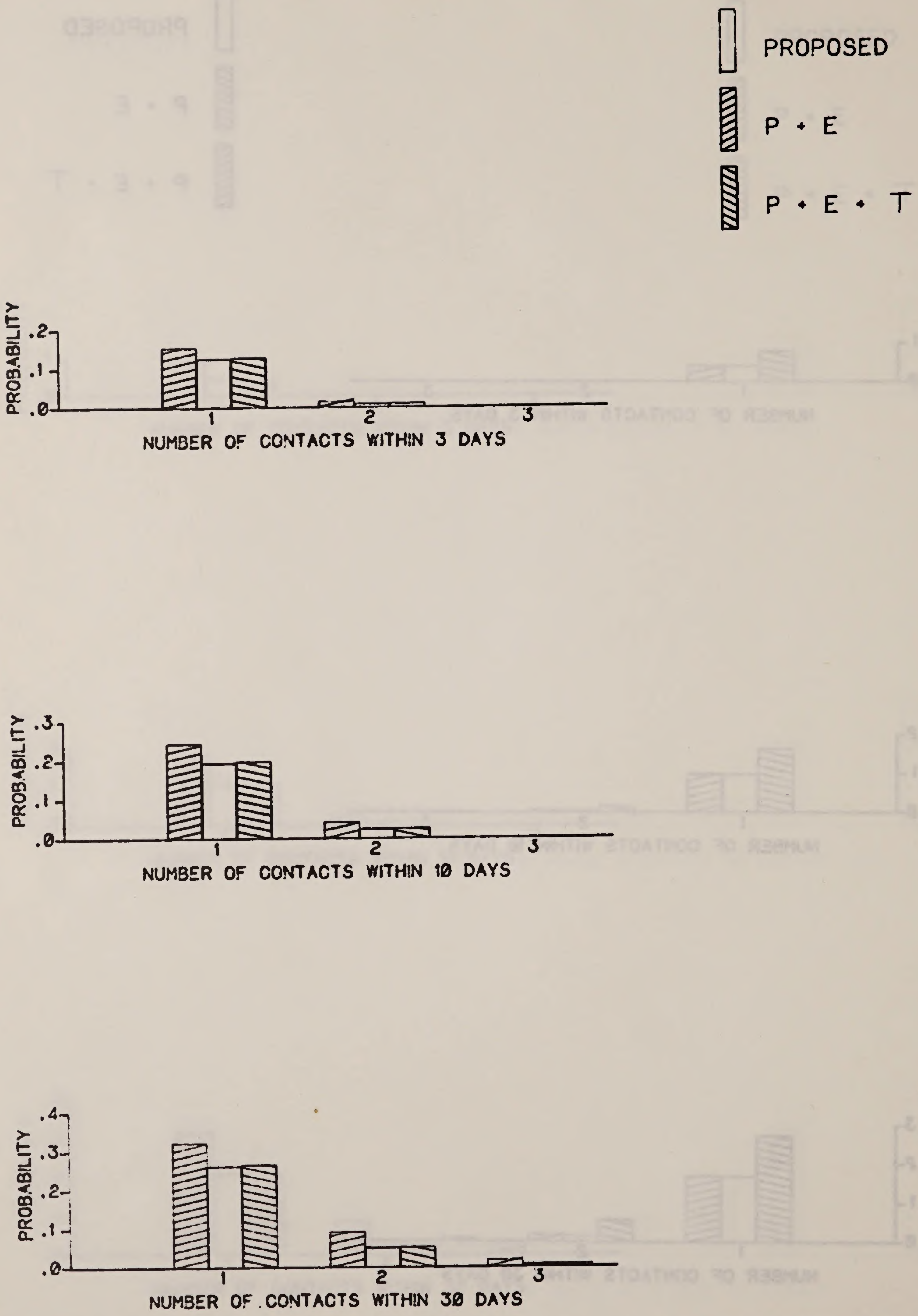


Figure B-7.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting coastal inlets of Georgia as a result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

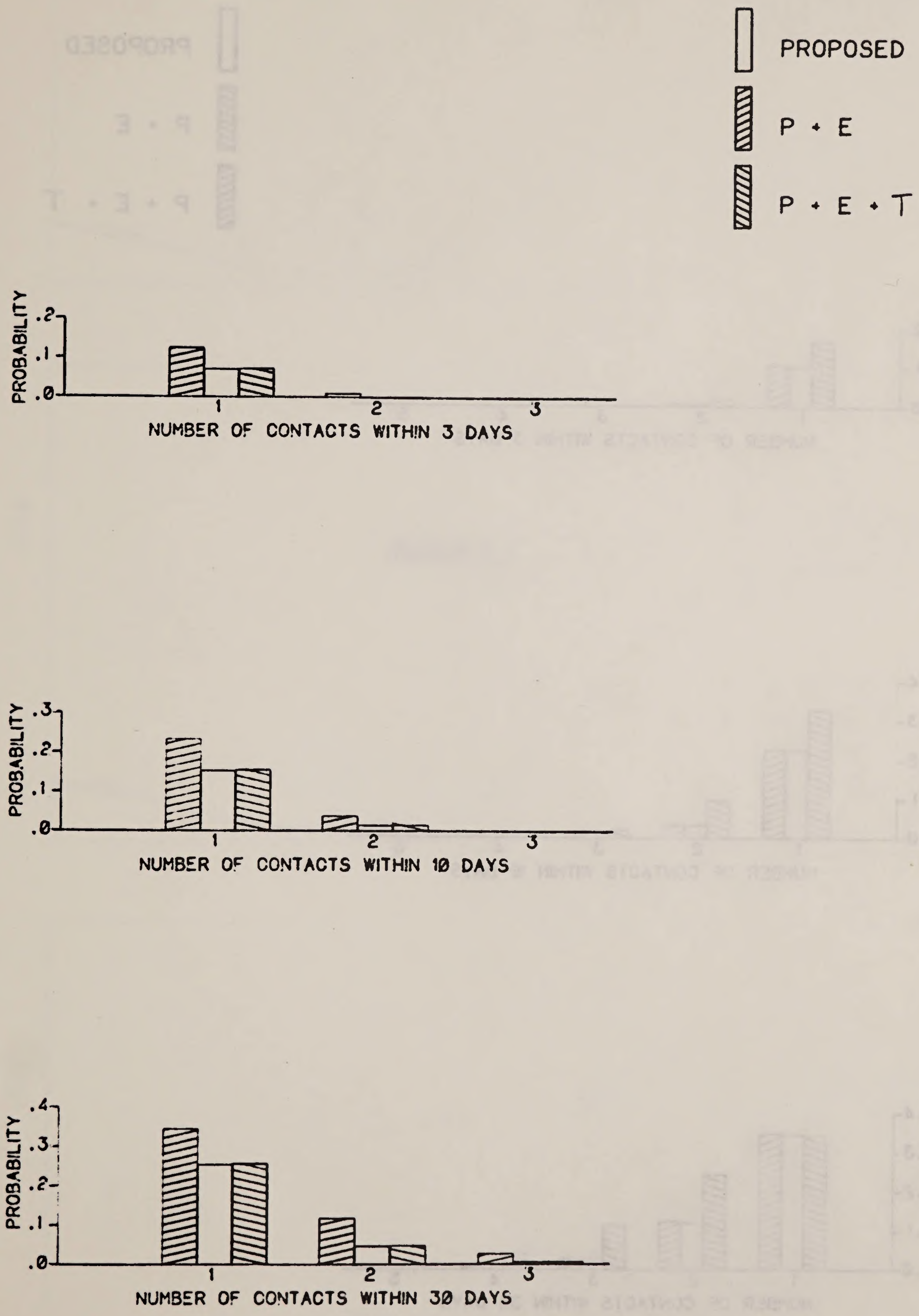


Figure B-8.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting historic sites as a result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

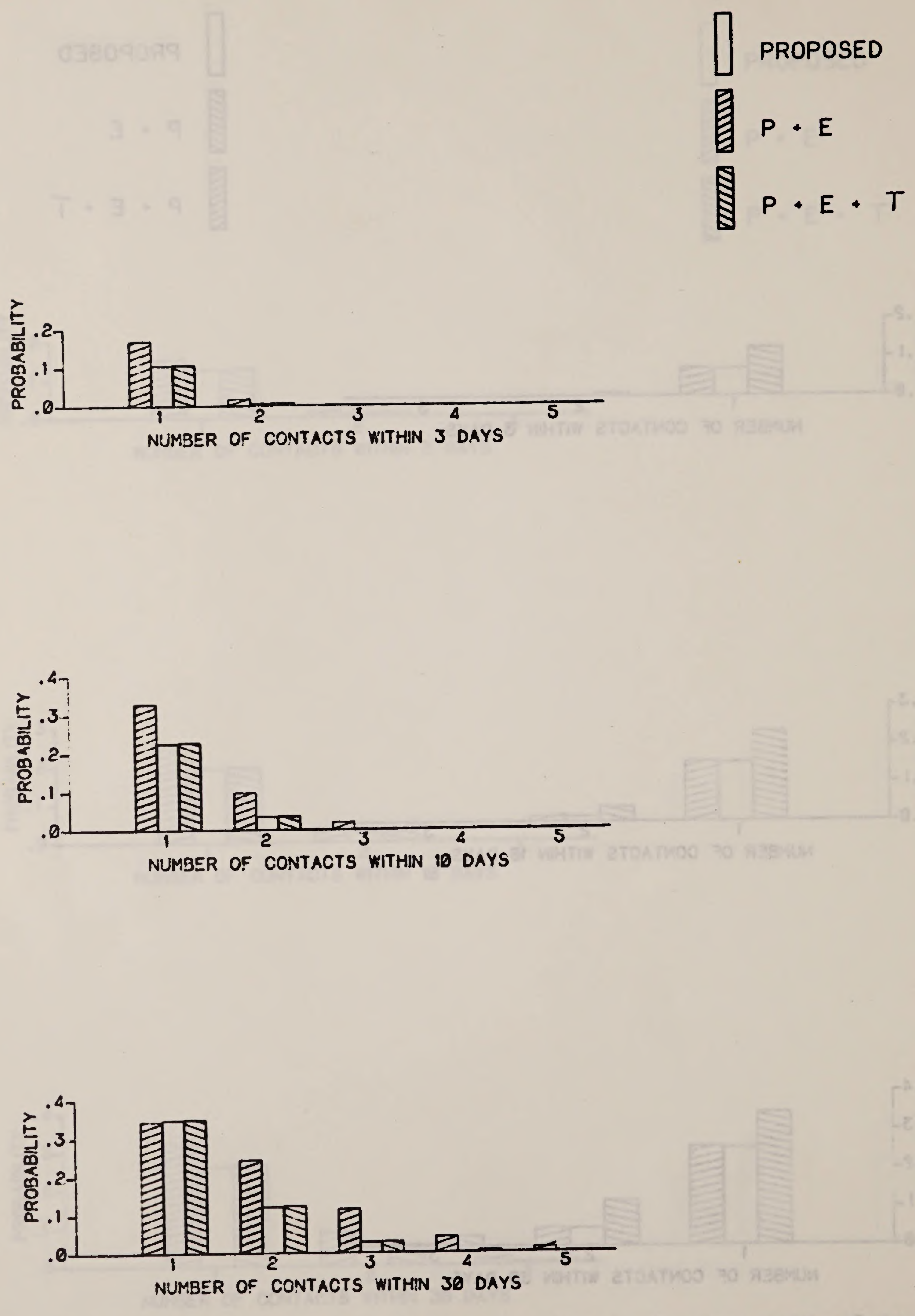


Figure B-9.--Histograms showing the probabilities of specific numbers of oilspills occurring and contacting land as a result of OCS Sale 56, OCS Sales 56 and 43, and OCS Sales 56 and 43 with existing tanker transportation.

Appendix C

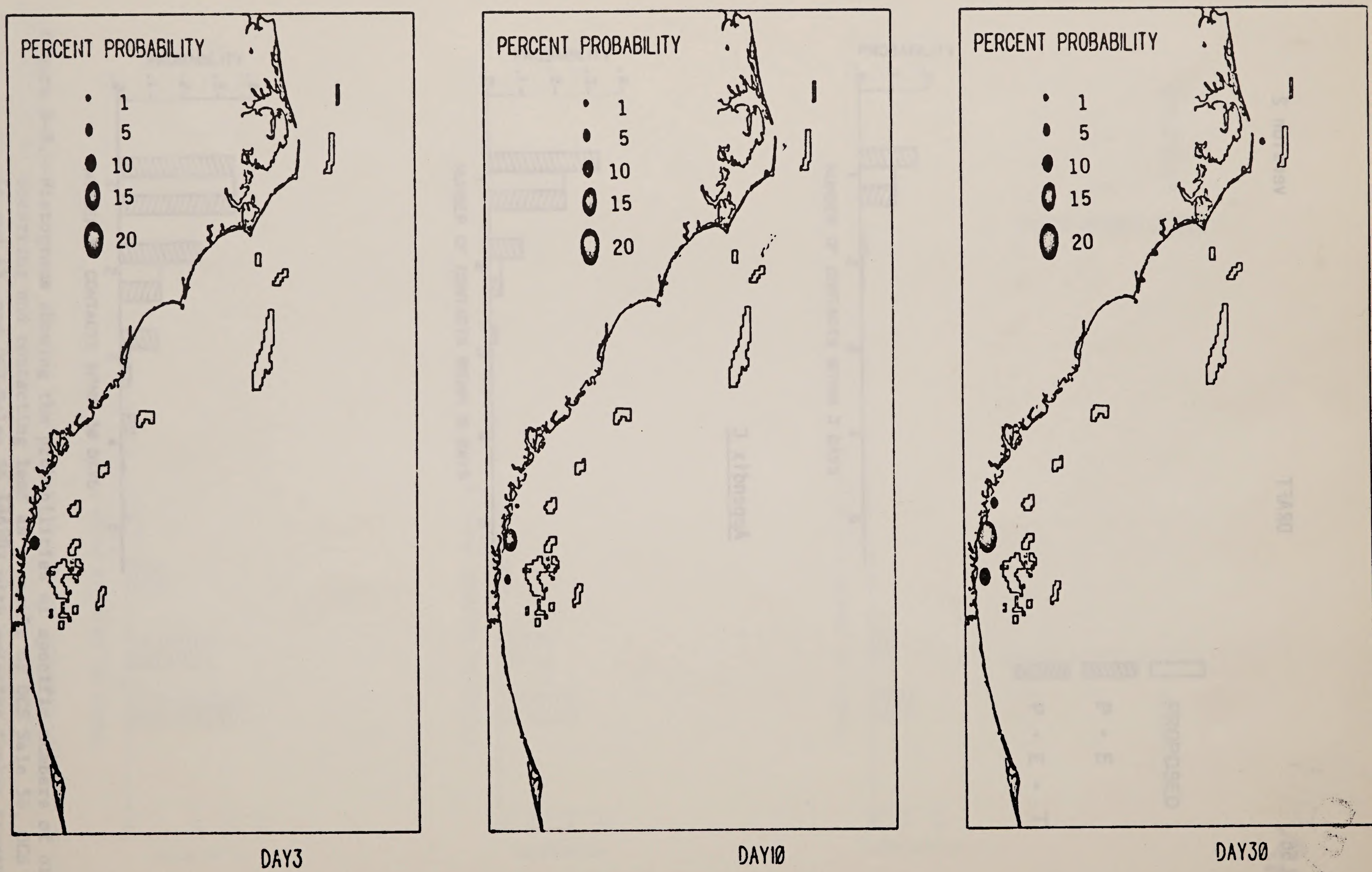


Table C-1.--Maps showing the probability (percent chance) of one or more spills occurring and contacting sections of the coastline (set 1) for 3, 10, and 30 day travel times.

Appendix D

Table D-1.-- Probabilities (expressed in percent chance) of one or more spills, the most likely number of spills, and the expected number of spills occurring and contacting targets over the production life of the lease area and for existing tanker transportation.

Target	Within 3 days: Proposed Prob	Mode	Mean	Within 3 days: Existing, Proposed and, Tankering Prob	Mode	Mean
Land	11	0	0.1	19	0	0.2
Brown Pelican	23	0	0.3	28	0	0.3
Marine Turtle	8	0	0.1	12	0	0.1
Onslow Bay Live Bot.	21	0	0.2	30	0	0.4
Wildlife Conser.	1	0	0.0	9	0	0.1
Parks (May-Oct)	5	0	0.0	9	0	0.1
Parks (Nov-Apr)	4	0	0.0	8	0	0.1
Blkbrd, Sapelo, Wolf	n	0	0.0	n	0	0.0
Gray's Reef	1	0	0.0	3	0	0.0
Cape Romain Wild.	n	0	0.0	n	0	0.0
Monitor	1	0	0.0	2	0	0.0
Tourist Beaches, NC	1	0	0.0	2	0	0.0
Tourist Beaches, SC	n	0	0.0	1	0	0.0
Tourist Beaches, GA	8	0	0.1	9	0	0.1
Tourist Beaches, FL	n	0	0.0	4	0	0.0
Coastal Inlets, NC	4	0	0.0	5	0	0.1
Coastal Inlets, SC	n	0	0.0	2	0	0.0
Coastal Inlets, GA	13	0	0.1	17	0	0.2
Coastal Inlets, FL	n	0	0.0	5	0	0.0
Historic Sites	7	0	0.1	13	0	0.1
Prehistoric sites	n	0	0.0	n	0	0.0

Target	Within 10 days: Proposed Prob	Mode	Mean	Within 10 days: Existing Proposed and, Tankering Prob	Mode	Mean
Land	26	0	0.3	45	0	0.6
Brown Pelican	30	0	0.4	45	0	0.6
Marine Turtle	17	0	0.2	30	0	0.4
Onslow Bay Live Bot.	26	0	0.3	37	0	0.5
Wildlife Conser.	7	0	0.1	26	0	0.3
Parks (May-Oct)	11	0	0.1	21	0	0.2
Parks (Nov-Apr)	10	0	0.1	18	0	0.2
Blkbrd, Sapelo, Wolf	2	0	0.0	3	0	0.0
Gray's Reef	6	0	0.1	10	0	0.1
Cape Romain Wild.	n	0	0.0	1	0	0.0
Monitor	5	0	0.1	8	0	0.1
Tourist Beaches, NC	4	0	0.0	6	0	0.1
Tourist Beaches, SC	n	0	0.0	1	0	0.0
Tourist Beaches, GA	13	0	0.1	16	0	0.2
Tourist Beaches, FL	1	0	0.0	10	0	0.1
Coastal Inlets, NC	7	0	0.1	11	0	0.1
Coastal Inlets, SC	1	0	0.0	5	0	0.0
Coastal Inlets, GA	22	0	0.2	29	0	0.3
Coastal Inlets, FL	1	0	0.0	8	0	0.1
Historic Sites	17	0	0.2	27	0	0.3
Prehistoric sites	n	0	0.0	2	0	0.0

Target	Within 30 days: Proposed Prob	Mode	Mean	Within 30 days: Existing, Proposed and, Tankering Prob	Mode	Mean
Land	50	0	0.7	76	1	1.4
Brown Pelican	40	0	0.5	63	1	1.0
Marine Turtle	33	0	0.4	55	0	0.8
Onslow Bay Live Bot.	31	0	0.4	49	0	0.7
Wildlife Conser.	19	0	0.2	47	0	0.6
Parks (May-Oct)	24	0	0.3	43	0	0.6
Parks (Nov-Apr)	19	0	0.2	34	0	0.4
Blkbrd, Sapelo, Wolf	4	0	0.0	6	0	0.1
Gray's Reef	10	0	0.1	16	0	0.2
Cape Romain Wild.	1	0	0.0	3	0	0.0
Monitor	10	0	0.1	18	0	0.2
Tourist Beaches, NC	12	0	0.1	19	0	0.2
Tourist Beaches, SC	3	0	0.0	7	0	0.1
Tourist Beaches, GA	19	0	0.2	26	0	0.3
Tourist Beaches, FL	3	0	0.0	18	0	0.2
Coastal Inlets, NC	16	0	0.2	26	0	0.3
Coastal Inlets, SC	7	0	0.1	17	0	0.2
Coastal Inlets, GA	32	0	0.4	43	0	0.6
Coastal Inlets, FL	3	0	0.0	13	0	0.1
Historic Sites	31	0	0.4	49	0	0.7
Prehistoric sites	2	0	0.0	7	0	0.1

Note: n = less than 0.5 percent.

Table D-2. -- Probabilities (expressed in percent chance) of one or more spills, the most likely number of spills, and the expected number of spills occurring and contacting land segments (set 1) over the production life of the lease area and for existing tanker transportation.

Land Segment	Within 3 days: Proposed			Within 3 days: Existing, Proposed and, Tankering			Within 10 days: Proposed			Within 10 days: Existing, Proposed and, Tankering			Within 30 days: Proposed			Within 30 days: Existing, Proposed and, Tankering		
	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean
2	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	3	0	0.0
3	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	6	0	0.1
4	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	4	0	0.0	7	0	0.1
5	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	3	0	0.0
6	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	3	0	0.0	6	0	0.1
7	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	2	0	0.0	3	0	0.0
8	n	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0	3	0	0.0	5	0	0.0
9	1	0	0.0	2	0	0.0	2	0	0.0	3	0	0.0	3	0	0.0	4	0	0.0
12	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	2	0	0.0
13	n	0	0.0	1	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	6	0	0.1
14	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	3	0	0.0
15	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0
16	n	0	0.0	1	0	0.0	n	0	0.0	3	0	0.0	2	0	0.0	6	0	0.1
17	n	0	0.0	1	0	0.0	2	0	0.0	4	0	0.0	6	0	0.1	9	0	0.1
18	8	0	0.1	9	0	0.1	13	0	0.1	15	0	0.2	18	0	0.2	23	0	0.3
19	1	0	0.0	2	0	0.0	5	0	0.0	8	0	0.1	10	0	0.1	15	0	0.2
20	n	0	0.0	3	0	0.0	1	0	0.0	6	0	0.1	2	0	0.0	9	0	0.1
21	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0	n	0	0.0	4	0	0.0
22	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	2	0	0.0
23	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	n	0	0.0	3	0	0.0
24	n	0	0.0	n	0	0.0	n	0	0.0	3	0	0.0	n	0	0.0	8	0	0.1

Note: n = less than 0.5 percent. Those land segments for which all probabilities of one or more spills are less than 0.5 percent are not shown.

Table D-3. -- Probabilities (expressed in percent chance) of one or more spills, the most likely number of spills, and the expected number of spills occurring and contacting land segments (set 2) over the production life of the lease area and for existing tanker transportation.

Land Segment	Within 3 days: Proposed			Within 3 days: Existing, Proposed and, Tankering			Within 10 days: Proposed			Within 10 days: Existing, Proposed and, Tankering			Within 30 days: Proposed			Within 30 days: Existing, Proposed and, Tankering		
	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean	Prob	Mode	Mean
2	n	0	0.0	n	0	0.0	2	0	0.0	3	0	0.0	6	0	0.1	11	0	0.1
3	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	3	0	0.0	4	0	0.0
4	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	5	0	0.0	9	0	0.1
5	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	2	0	0.0
6	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0
7	1	0	0.0	2	0	0.0	2	0	0.0	3	0	0.0	4	0	0.0	6	0	0.1
8	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	2	0	0.0
10	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0
11	n	0	0.0	1	0	0.0	n	0	0.0	3	0	0.0	4	0	0.0	9	0	0.1
13	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	2	0	0.0	4	0	0.0
14	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0
15	n	0	0.0	1	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	5	0	0.0
16	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	2	0	0.0	3	0	0.0
17	n	0	0.0	n	0	0.0	2	0	0.0	3	0	0.0	4	0	0.0	6	0	0.1
18	7	0	0.1	7	0	0.1	10	0	0.1	12	0	0.1	14	0	0.2	18	0	0.2
19	3	0	0.0	3	0	0.0	7	0	0.1	8	0	0.1	11	0	0.1	15	0	0.2
20	n	0	0.0	n	0	0.0	2	0	0.0	2	0	0.0	3	0	0.0	5	0	0.0
21	n	0	0.0	3	0	0.0	1	0	0.0	5	0	0.0	2	0	0.0	7	0	0.1
22	n	0	0.0	1	0	0.0	n	0	0.0	4	0	0.0	1	0	0.0	8	0	0.1
23	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0
24	n	0	0.0	n	0	0.0	n	0	0.0	1	0	0.0	n	0	0.0	5	0	0.0
25	n	0	0.0	n	0	0.0	n	0	0.0	3	0	0.0	n	0	0.0	9	0	0.1

Note: n = less than 0.5 percent. Those land segments for which all of the probabilities of one or more spills are less than 0.5 percent are not shown.

APPENDIX E

ENVIRONMENTAL STUDIES

APPENDIX E

ENVIRONMENTAL STUDIES

The basic issues in the South Atlantic/Blake Plateau areas which environmental studies address or propose to address for OCS Lease Sale 56 are: (1) the socioeconomic effect of OCS activity; (2) the effects of OCS activity on the biological environment, productive biological features, and endangered species; (3) the effects of OCS activitities on shelf fish populations; (4) the location of geological hazards and their potential for affecting exploration, development and production; and (5) the proper safety in construction of rigs, platforms, pipelines and nearshore facilities.

One lease sale has already been held in the South Atlantic OCS region (Sale 43 in March 1978; between Cape Canaveral, Florida and Cape Fear, North Carolina). A large amount of baseline environmental data was collected in preparation for Sale 43. Other studies addressing the basic issues are completed, in progress, or in planning.

The study area for several studies (geological hazards, physical oceanography, living marine reosurces) has been expanded to include the North Carolina OCS region. This work will provide adequate information in an area where industry has recently displayed interest.

The following list of studies provides a brief overview of the work in progress and the expected due date for the study products.

COMPLETED CONTRACTS

1. CT6-5. SOUTH ATLANTIC OCS STUDIES CONFERENCE

Objectives:

A. To provide a summary of available related information and understanding for the South Atlantic Outer Continental Shelf area.

B. To provide any predictions presently possible of the effects of drilling (exploration and development) on the environment in this area.

C. To identify subject areas in which additional information is required for reasonable prediction and understanding of the environmental effects of drilling in this area.

D. To formulate recommendations for baseline studies and monitoring, which will help to adequately determine the environmental effects of any oil and gas exploration and development in the South Atlantic Outer Continental Shelf area.

Final Report Not Available

2. IA6-3. SOUTH ATLANTIC DATA BUOY

Objective:

A Data Buoy was deployed off of Charleston, S.C., so that a more definitive knowledge of the physical oceanography of the Georgia Embayment can be obtained. The buoy is equipped with equipment to collect meteorological information and sea surface data (water temperature and integrated wave spectra).

No Final Report

3. MU6-56. SOUTH ATLANTIC GEOLOGICAL STUDIES

The objectives of the U. S. Geological Survey's geologic environmental research program were to: (1) measure the rate of sediment mobility over the sea bed and to monitor resultant changes in bottom morphology and texture; (2) determine the concentration, distribution and flux of suspended particulate matter in the water column: (3) determine the vertical distribution of trace metals in the near surface sediment at selected locations; (4) evaluate

potential geologic hazards to oil and gas development due to surficial and intermediate depth structure and mass sediment transport events; (5) to identify and determine the significance of outcrop and reef structures; and (6) support the activities of the chemical/biological benchmark contractor by obtaining supportive sediment texture, composition, and physical oceanographic information.

Final Report Available Thru NTIS No. PB-300-820/AS

4. CT8-25. SOUTH ATLANTIC OCS HARD BOTTOMS STUDY

Objectives:

Oil and gas lease tracts are routinely surveyed prior to drilling activities for shallow geologic hazards that include sediment instability, faulting, and shallow gas. These multi-sensor high-resolution engineering surveys are generally performed with a precision depth recorder, side scan sonar, subbottom profiler, and other geophysical equipment including sparkers, boomers, or air guns. The geologic hazards survey records from tracts leased in the Georgia Bright are to be interpreted for the presence of hard (live or hard) bottom areas within 1,820 meters of any proposed oil and gas exploration or production site (USDI, 1987a,b). These live bottom areas have been defined as "those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography, or whose lithotype favors the accumulation of turtles, fishes, and other fauna" (USDI, 1978a). These areas have been considered to be sufficiently unique and sensitive to require protection from the possible deleterious effects of oil and gas drilling operations. They therefore require identification and characterization prior to drilling activities so that measures may be taken to protect the areas if it is determined that they might be adversely impacted by the proposed activities.

Final Report Available Thru NTIS PB-300-821/AS

5. CT7-2. SOUTH ATLANTIC OCS BENCHMARK STUDY

Objectives:

A. Initiate seasonal studies to determine the concentration ranges of high molecular weight (HMW) hydrocarbons and trace metal concentrations in selected benthic macrofaunal species preceding oil and gas development.
B. Initiate seasonal studies to determine the existing ranges of HMW hydrocarbons and trace metal concentrations in selected benthic macrofaunal species preceding oil and gas development.
C. Initiate quantitative seasonal studies of benthic infaunal (500-um) communities, meiofaunal (62- to 500-um) communities, and foraminiferal populations to determine the natural ranges of selected parameters.
D. Initiate histological studies to determine the tissue condition of selected benthic macrofaunal species preceding oil and gas development.
E. Describe seasonal variations in the concentrations of HMW hydrocarbons and selected trace metals in the water column.
F. Enumerate heterotrophic and hydrocarbon-oxidizing microorganisms; identify dominant microbial species in the surface microlayer film, near-surface water, and sediments and evaluate the oil-degrading potential of these organisms; and examine the relationship between oil concentration and the ratio of hydrocarbon-oxidizing microbes to aerobic heterotrophic microbes.
G. Collect samples and perform analyses in support of benchmark data interpretation and collect samples and data in support of the South Atlantic study programs conducted by the U.S. Geological Survey (USGS) and the physical oceanography contractor (Science Applications, Inc.).

Report Submitted to NTIS But Not Available Yet

6. CT7-16 SOUTH ATLANTIC OCS PHYSICAL OCEANOGRAPHY LITERATURE SYNTHESIS

Objectives:

A. Identify and assemble recent oceanographic and meteorological data not available from the National Oceanographic Data Center (NODC) or National Climate Center (NCC) for the South Atlantic region.
B. Organize the data on tapes in formats that are compatible with NODC/NCC and transmit them to NODC/NCC.
C. Update a previously prepared Council on Environmental Quality (CEQ) bibliography for the region.
D. Use recent and previously catalogued data to describe, display, analyze and interpret oceanographic and meteorological phenomena in the region.
E. Make recommendations for future sampling and buoy sites and programs based on the preceding analyses and a review of raw data and unworked samples.

Final Report Will Be Submitted To NTIS

7. CT7-29. SOUTH ATLANTIC OCS PHYSICAL OCEANOGRAPHY FIELD STUDY

Objectives:

A. Study the transport of surface and near-surface borne materials across and/or along the turbid-clear water interface of the Georgia Embayment during both wet and dry seasons, as a first step towards and assessment of the ability of this feature to act as a natural barrier to the migration of pollutants towards shore or estuaries of the Embayment (Dr. E. Waddell, SAI, Principal Investigator).
B. Analysis of current and temperature time series obtained near shelf edge to monitor the effects of Gulf Stream intrusions. Current meters were to be emplaced in support of hydrography conducted by the Benchmark Contractor, and integrated in a box array deployed under the auspices of DOE to provide optimum cross-shelf resolution (Dr. T. Lee, University of Miami, Principal Investigator).
C. Establishment of a long-term current meter station to determine the mean flow and the extent of perturbations at near-surface, mid-water, and near-bottom depths, due to meteorological forcing and Gulf Stream pulsing action.
D. Monitoring of seasonal characteristics of shelf water masses and of short-term variations in shelf edge water masses (i.e., fluctuations of the position of the western edge of the Gulf Stream) using Very High Resolution Radiometer (VHRR) satellite imagery.
E. Correlation of surface wind and wave field data on the South Atlantic OCS with coastal conditions, National Weather Service predictions, and information derived from satellite imagery in support of the interpretation of subsurface current measurements.

Final Report Will Be Submitted To NTIS

8. CT7-39. SOUTH ATLANTIC OCS LITERATURE SYNTHESIS

Objectives:

A. Update the environmental survey by VIMS (1974) and provide analysis of all existing biological, chemical, and geological data.
B. Identify and summarize ongoing biological, chemical, and geological programs in the South Atlantic region.
C. Identify sources of raw data and unworked samples, and evaluate the role of this material in relation to the total existing data base.
D. Identify gaps in the biological, chemical, and geological data base and evaluate the extent of these gaps.

Final Report Not Available Yet

9. MU8-12. SOUTH ATLANTIC - SOUTH TEXAS MARINE BIRDS STUDY

Objective:

To obtain and organize all information from the literature, unpublished reports, personal communications, and other sources that relate to marine birds and their interfacing with OCS deployment in the south Texas and South Atlantic lease areas.

Final Report Not Received Yet

10. MU8-13. SOUTH ATLANTIC OCS GEOLOGICAL STUDIES FY'78

Objectives:

A. To determine the sedimentation rates and processes on the upper slope and inner Blake Plateau.
B. To determine the distribution, areal extent, and vertical characteristics of geological features supportive of biological communities.
C. To monitor the transport of bottom sediment across the OCS; evaluate its possible effect on pollutant transfer along the seabed and the potential of sediment as a pollutant sink; determine the implications of erosion/deposition on pipeline emplacement; and aid the interpretation of chemical, biological, and physical data.
D. To define the concentration, composition, areal distribution, variation, source, and rate of movement of particulate matter suspended in the OCS water column.
E. To study the shelf edge and slope near areas of oil and gas interest and the northern portion of the Blake Plateau for evidence of geological instability.
F. To determine the depth and rate of sediment mixing caused by large storms and/or by benthic organisms and where possible to estimate the rate of active sediment accumulation.

Final Report Not Received Yet

11. CT8-34. SOUTH ATLANTIC PHYSICAL OCEANOGRAPHY MODELING - PHASE I

Objective:

Accomplish a qualitative assessment of those models and analytical tools that are relevant to Bureau of Land Management South Atlantic OCS studies program objectives. This work involved the recognition and classification of models applicable to the prediction and hindcasting of: transport pathways of positively and negatively buoyant contaminants, including sediment; diffusion and dispersion of these contaminants; and the potential for damage or rupture of structures and pipelines on the continental margin under varying atmospheric and oceanic wave and current conditions.

Final Report Not Received Yet

12. IA8-37. SOUTH ATLANTIC OCS DATA BUOY

Objective:

This is an extension of the 1976 Study IA6-3. Two (2) buoys were deployed so that a more definite knowledge of the physical oceanography of the South Atlantic can be obtained. The buoys are equipped with equipment to collect meteorological information and sea surface data (water temperature and integrated wave spectron).

No Final Report

13. IA8-39. SOUTH ATLANTIC SATELLITE OCEANOGRAPHY

Objective:

The primary objective is to provide satellite determined monthly information of the surface current, wave, and low level wind fields for the South Atlantic OCS, and to generate an analytical model and an computer program to describe the microscale characteristics of surface transport. In addition establishment of the validity and usefulness of the satellite acquired data through comparison with data from other sources so that the use of satellite data can become a routine part of future BLM programs where applicable to management decisions.

Final Report Not Received Yet

CURRENT STUDIES

14. CT8-40. SOUTH ATLANTIC CULTURAL RESOURCES EVALUATION STUDY

Objective:

The geographical area to be covered extends from Cape Hatteras, North Carolina, to Key West, Florida, and seaward from the mean high water line to the 200 m isobath. The objectives of this study include: (1) a review of the late Quarternary geology of the area, as it relates to the cultural resources; (2) an assessment of the total cultural resources that could be found; (3) determination of probability of resource occurrence by area and/or feature; (4) identification of potential pilot study areas; (5) a review of present study techniques and recommendations for modification of search and recovery techniques; and (6) delineation of significant data deficiencies.

Final Report Not Received Yet

15. CT8-52. SOUTH ATLANTIC OCS PHYSICAL OCEANOGRAPHY STUDY FY'79

Long Range Objectives of the Physical Oceanography Study:

A. Describe and understand the currents, circulation, and mixing processes in the Georgia Embayment/South Atlantic OCS region in sufficient detail to:
1. Predict the dispersal, dilution, flushing and final distribution of hydrocarbons and other pollutants that may be introduced into the marine environment as a result of OCS related oil and gas (O&G) activities.
2. Provide information necessary to understand the biological, geological and chemical systems in the Georgia Embayment and the effects of hydrocarbons and other pollutants on these systems.

B. The physical oceanography study is expected to provide an understanding of the physical processes involved in the transport and dispersal of suspended and dissolved materials in Georgia Embayment waters sufficiently to parameterize these processes in descriptive models. Such models will permit a rational prediction of the probability of the paths along which potential contaminants associated with oil drilling may reach population centers of areas of biological importance, and the intensity of any environmental impacts arising from that. In conjunction with concurrent biological habitat studies, the physical model aids in estimating the probability of O&G related pollutant effect on biological productivity of the continental shelf.

Final Report Not Yet Received

16. MU9-8. SOUTH ATLANTIC OCS GEOLOGICAL STUDIES

Objective:

A. To determine the distribution, areal extent, and vertical characteristics of geological features supportive of biological communities.

B. To conduct a geophysical survey utilizing side-scan sonar, a uniboom high resolution seismic reflection system, 3.5 kHz tuned transducer, and underwater towed television. Positioning shall be by Loran-C receivers supplemented by satellite fixes.

C. To study the shelf near areas of oil and gas interest and possible pipeline corridors for evidence of geological instability. To map the geologic units offshore associated with the principal aquifer onshore.

D. A geophysical survey including high-resolution reflection (minisparker and 3.5 kHz) airgun, and precision depth recording shall be conducted over the southern portion of the Georgia Embayment.

E. A seismic survey off North Carolina shall be conducted to define geologic hazards.

Final Report Not Received Yet

17. MU9-18. SOUTH ATLANTIC AND GULF OF MEXICO ENDANGERED SPECIES PILOT STUDY

Objective:

1) Collect and analyze field data about the distribution and abundance of the organisms named herein; 2) develop software for analysis and archival of field data; 3) identify and describe areas of special biological significance; 4) obtain and synthesize available data and literature about marine mammals, turtles, and manatees in the entire study area; and 5) develop a comprehensive study plan for expanding the field studies from the initial two subunits of the study area to the area from Cape Hatteras, North Carolina, around the southern tip of Florida and westward along the OCS to Brownsville, Texas.

Final Report Not Received Yet

18. IA9-24. SOUTH ATLANTIC PHYSICAL OCEANOGRAPHIC DATA COLLECTION

Objective:

Both the Bureau of Land Mangement and the Department of Energy are funding major oceanographic studies in the South Atlantic OCS region. These programs are well coordinated to ensure minimal duplication of effort and maximum use of available resources. Both programs are into the final planning and procurement stages for the 1980 sampling year. BLM funds are being used to guarantee ship-time. The ship-time used for joint BLM-DOE cruises to deploy and recover current meters and collect hydrographic samples.

Final Report Not Received Yet

19. CT9-27. SOUTH ATLANTIC OCS LIVING MARINE RESOURCES

Objective:

The present study has been developed to contribute to our basic understanding of these habitats, with the following general questions in mind:

(1) What are live bottoms, and why ar they important?

(2) What are the interrelationships between live bottom habitats and adjacent non-living bottom habitats?

(3) What are the spatial and temporal patterns of utilization of these habitats by selected nektonic and demersal species?

(4) Are current lease stipulations properly directed, or should more consideration be given to benthic habitat types other than live bottoms?

"Live Bottom Areas are defined as those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or whose lithotope favors the accumulation of turtles and fishes."

Final Report Has Not Been Received

20. CT9-32. SOUTH ATLANTIC OCS CIRCULATION MODEL APPLICATION

Objective:

The objectives of this effort are to: adapt the model, specified by the BLM, to the South Atlantic OCS region; test the model with appropriate existing data; document the model for the Bureau's use; provide recommendations for the type, quantity and quality of additional data needed to improve the model's effectiveness; and provide quantitative values of the seasonal surface circulation for use in the Department of Interior oil spill risk analysis model.

Final Report Not Received Yet

21. CT0-12. SOUTH ATLANTIC OCS PHYSICAL OCEANOGRAPHY FIELD STUDY

Objective:

The long range objectives of the South Atlantic OCS Physical Oceanography Field Study are to describe and understand the currents, circulation and mixing processes in the Georgia Embayment/South Atlantic OCS region in sufficient detail to:

1. Predict the dispersion dilution transport and final distribution of hydrocarbons and other pollutants that may be introduced into the marine environment as a result of OCS related oil and gas (O&G) activities.
2. Provide circulation and forcing information necessary to understand the biological, geological and chemical system in the Georgia Embayment and the effects of hydrocarbons and other pollutants on these systems.

Final Report Has Not Been Received

22. MU0-16. SOUTH ATLANTIC OCS GEOLOGICAL STUDIES

The fourth year geological program shall, in part, continue efforts included in the first (AA550-MU6-56), second (AA551-MU8-13), and third (AA551-MU9-8) years' study in those elements where earlier study results justify a continuation for the purpose of supporting BLM's mission directly and furnishing information necessary to enable other BLM investigators to better accomplish their contributive effort.

The objective of this study is to indicate the areas of interest that the BLM has for the fourth year geological oceanography program for the South Atlantic OCS region. The effort shall consist, at a minimum, of the characterization by mapping and interpretive narration of several geological parameters of the South Atlantic OCS region shown in Fig. 1. These geological parameters are: (1) potentially mobile bedforms; (2) structures supportive of potentially sensitive biological communities; (3) bottom sediment mobility; and (4) shallow geological instabilities. Additionally the area between 30^{o}N and 32^{o}N Lat. and 80^{o}W to 82^{o}W long. will be mapped as part of the USGS Geologic Atlas Series.

Final Report Not Received

23. MU0-21. ENDANGERED SPECIES STUDY

Objectives:

A. To determine and confirm which species of marine mammals, birds and turtles inhabit or migrate through the OCS areas of the South Atlantic and Gulf of Mexico.
B. To investigate temporal and spatial distribution of these species and the patterns of movement associated with such distributions.
C. To idendify, delineate, and describe any areas of special biological significance for feeding, migration, and maintenance of populations encountered.
D. To provide a basis for estimating relative abundance of individual species within the study area.
E. To amplify the understanding of population structure and basic ecology of poorly known species or populations where possible.
F. To formulate specific questions and investigative lines for subsequent research relevant to effects of oil and gas development and other research priorities in OCS areas of mammal, bird and turtle fauna.

Manatee Studies

In a second major data gap identified by previous studies and by BLM is the scarcity of reliable information on the West Indian Manatee, and endangered marine sirenian. Manatees are known to be injured and killed by collision with marine traffic, especially in nearshore areas and inshore waterways of Florida. The actual distribution, habits and overall status of manatees in two major ports (i.e., Tampa and Jacksonville) are largely unknown. It is believed that oil spills may result in deleterious effects on individual manatees and on their food sources. Manatees congregate in warm water areas during winter months and populations are especially vulnerable during such periods.

The information needed to assess the impact of OCS development on manatees includes investigation of local populations in close proximity to major ports and maritime traffic, determination of seasonal dispersal and aggregation along the coast of Georgia, and definition of major areas and habitats of importance to manatees.

The objectives of the proposed study have been designed to respond sequentially to these needs. Populations in Tampa and Jacksonville, Florida, areas will be studied in FY 80 and considered in FY 81. Coastal studies from northern Florida to South Carolina will be proposed in FY 81. Study of special areas and habitats of biological importance to manatees will be proposed for FY 82. The objectives of the manatee studies are:

Final Report Not Available Yet

Contract Date: January 15, 1980
Completion: July, 1981

24. CT0- BLAKE PLATEAU BOTTOM AND MID-WATER CURRENT STUDY

This study will provide bottom current information across the Blake Plateau at four locations, bottom currents on the shelf edge, and mid-water currents in the Gulf Stream for the period of one year. This will provide BLM and USGS with data needed to determine risks in drilling and emplacing bottom production and transportation facilities. The data, when coupled with hydrographic data (collected under the physical oceanographic field study) will provide valuable input to the South Atlantic OCS circulation model. The current meters will be deployed for six months along 30^{o}N latitude. The meters will be replaced for a second six months to provide a full year's information. The final report will include mean velocities, coherence across the plateau and an interpretation of the data.

Final Report Not Available

Contract Date: April, 1980

25. WEST FLORIDA SHELF BENTHIC STUDY, YEAR 1

Objective:

A. The determination of macroinfauna species composition, diversity and biomass (molluscs and polychaetes) at selected stations which are close to anticipated oil and gas activity. This work will describe and quantify the assemblages.
B. The completion of grain size and carbonate analyses on sediment samples at selected stations.
C. The determination of trace metal and hydrocarbon content of sediments at selected stations.
D. The examination of foraminifera in the sediment at selected stations (indicators of environmental perturbations).
E. The determination of benthic macrofauna composition and variability in 100 to 200 meter depths on the West Florida Shelf.

Final Report Not Available Yet

Contract Date: July, 1980
Completion: January, 1982

AVAILABILITY OF ENVIRONMENTAL STUDIES INFORMATION PRIOR TO FINAL REPORT PUBLICATION

There are several avenues through which states may receive information from the environmental studies program prior to publication of final reports.

The Intergovernmental Planning Program (IPP) Regional Technical Working Groups meet in the New Orleans OCS Office on several occasions annually. Discussion of the studies program is usually an agenda item for these meetings. Ample opportunities are provided for the IPP members to meet with members of the Studies Staff and the Environmental Assessment Division. Studies information is often transferred to IPP members during these meetings.

The New Orleans OCS Studies Staff holds ternary environmental studies meetings where program managers and principal investigators meet to give presentations outlining the status of their particular studies. Federal, state, industry, and private interest group (IPP) committee members are invited to these meetings. This offers state representatives an excellent opportunity to question the researchers and report the current status of the environmental studies to their governors and other state agencies.

In addition to the ternary meetings, the New Orleans OCS Office has occasional meetings at certain points in the lease sale process where environmental studies are discussed (prior to writing the Draft EIS, lease stipulations meetings, etc.). Representatives from the Studies Staff and the Environmental Assessment Division are present at these meetings. Again, this is an opportunity for IPP committee members to ask specific questions on environmental studies.

A quarterly report on the status of environmental studies is sent to the Washington Office (BLM Offshore Studies - 543) by each OCS field office. The New Orleans Office has included IPP members on this mailing list. The report includes a brief description of each study, the names of the individuals directly involved in managing the study, and a comment on the expected due date for reports.

If required, the IPP committee members can visit or telephone the New Orleans OCS Office to consult directly with the Studies Staff scientists coordinating the studies or with the Environmental Assessment Division scientists writing the EIS.

APPENDIX F

SCOPING FOR PROPOSED SALE 56

APPENDIX F

SCOPING FOR PROPOSED SALE 56

Table of Contents

1. Introduction

Scoping is a process to identify significant environmental issues and deemphasize insignificant ones, and to narrow the scope of the DEIS. The scoping process for proposed Sale 56 is discussed in detail in Section V; the information discussed in the following subsections only summarizes the major scoping procedures for this proposal.

2. Summary of Comments on Tract Nominations

In addition to tract nominations received in response to the "Call for Nominations," comments were received recommending the deletion of certain areas from consideration for oil/gas leasing. These comments were considered in the tract selection process and the majority of tracts located in these "recommended deletion areas" (RDA) were not selected for leasing. However, as a result of agency/industry interest some of the remaining RDA tracts were selected for inclusion in this proposed sale. Of the 286 tracts selected, 222 (78%) are within the recommended deletion areas. Of the 222 RDA tracts, 143 (64%) are within the Alternative B options. Environmental considerations do not warrant including the other 79 RDA tracts in the Alternative B options.

Described below are the RDA tracts, reason for recommended deletion, agency or group recommending deletion, and the specific Alternative B options which correlate to the RDA tracts.

RDA Tracts	Reason for Recommended Deletion	Agency/Group	Alternative B
25*, 40-45*, 214 and 224	Within 30 nmi of states' 3 nmi boundary	NRDC	B-1, B-2 and B-3
1-39*, 46-130*, and 162-174*	Beyond shelf break (greater than 200 m)	NRDC and Georgia Conservancy	B-1 and B-2
44*, 131-133, 135, 136, 147, 148, 152*-154, 156*-158, 160*, 189, 192-194, 197, 198, 200, 201, 204, 206, 208-214, 217-224, 226-233, 236-241, 246, 256, 261, 262, 265, 272, 274-276 and 278-286	Hard bottom communities (expected and reported)	NMFS	B-1 and B-3
41*, 42*, 45*, and 233	Shipwrecks	NMFS	B-3

* Tracts listed in one or more Alternative B options (see table IV-13).

3. Summary of Public Scoping Meetings

This subsection contains comments and concerns expressed during the six public scoping meetings held in the South Atlantic states and from other correspondence received in response to the proposal. The comments are grouped under 15 general topics in a question/statement format:

a. Aesthetics

Will any of the offshore platforms be visible from the shoreline?

Oil spills would affect the beauty of the ocean and beaches and impact the tourist industry.

b. Biologically Sensitive Areas

The DEIS should discuss coral reefs and potential impacts thereon.

c. Conservation and Alternative Energy Issues

Identify the development of oil/gas resources as a high priority part of a comprehensive, balanced national energy conservation and development program that gives consideration to full-scale energy conservation, alternative energy sources and short-and long-term resources availability.

A detailed discussion of alternate forms of energy should be included in the DEIS.

Consider immediate use of existing technology to insure that solar energy will be available to all.

d. Endangered Species

What is the potential impact on sea turtles, pelicans, and other endangered species? Also, potential impact on coastal bird rookeries in springtime when an oil spill could virtually eliminate the season's growth in the rookeries off Cape Hatteras?

e. Environmental Studies

The EIS should incorporate the latest data from the environmental studies program.

The EIS should discuss how BLM can feed information from the environmental studies program to the states prior to publication so they can make decisions.

The DEIS should contain a list of different projects and studies, both regional and national, along with the dates on which data can be expected.

f. Commercial Fisheries

An oil spill could ruin the surf and commercial fishing along the North Carolina coast.

The danger of an oil spill going down into the water column where major vertical migration occurs and where there is very heavy feeding could have drastic effect on commercial as well as sport fishing.

g. Land Use and Related Issues

All North Carolina coastal counties participated in the CAMA. This act required, among other things, that each county prepare a Land Development Plan which categorizes land uses according to local preferences/physical limitations. Is the proposal consistent with all coastal counties Land Development Plans? Is the proposal consistent with the State Coastal Plan?

If North Carolina cities/towns are used as bases of operation in either exploration or development, are there adequate accommodations in these towns to facilitate these secondary impacts? Are there adequate land use controls, i.e., zoning regulations, subdivision regulations, etc., to direct land development brought about by a large in-migration of staff and their families?

If shore dependent activities (refinery, storage, transshipping etc.) result from the proposals, what will be the localized impact resulting in a shift from tourism/sport and commercial fishing to industrial activities?

The EIS should discuss the criteria for siting and design of oil/gas facilities to minimize the onshore impact of these facilities.

h. Legal and Administrative

The DEIS should discuss the biological and cultural surveys currently required by GS rules and regulations.

The DEIS should discuss what process would be used if results of the 1980 and 1981 environmental studies program indicate that some leases needed to be terminated.

Is a separate environmental assessment required for offshore oil/gas exploration and development?

What is the role of the various government agencies and their responsibilities in the offshore oil/gas leasing process?

How is the proposed offshore oil/gas schedule established?

What amount of OCS oil/gas income is paid into the Land and Water Conservation Fund and how is it apportioned to the states?

At what points in the leasing process is there an opportunity for public participation?

How much and to what extent does the Geological Survey share its geophysical information with the Bureau of Land Management?

Will the public have a chance to participate (review/comment) on post-sale activities?

i. Noise

Is there any environmental concern with regard to noise produced by oil/gas operations?

j. Oil spills

Who is responsible for paying for the cleanup and environmental damage of oil spills?

Who is responsible for an oil spill at the national and state level and to what extent?

Concern "that there is not technology to contain oil spills should they occur in the kind of environment we have --- off Cape Hatteras, not only in the wintertime, but as occurred two weeks ago when there were eight and ten foot seas . . . . The booms . . . . do not work in high seas or in currents over two and three kilometers per hour."

What would be the effects of an oil spill similar to the Mexican spill on:

coastal marsh ecosystems (found in North Carolina, South Carolina, Georgia and Florida),

beaches and their tourist-based economies (particularly Daytona Beach),

commercial and recreational fisheries (including scallops, oysters, clams, crabs, and marine mammals?

What affect would oil spills have on the ocean food webs?

k. Oil Spill Risk Analysis

The DEIS should discuss the source of data verification for the oil spill model.

Would oil spills off North Carolina drift north with the Gulf Stream and not affect the North Carolina coastline?

Oil spilled into the Gulf Stream could affect marine life along the entire eastern coast of the U.S.

Wintertime impacts need to be evaulated. An oil spill in wintertime will not dissipate in 30 days because the lower water temperature would tend not to dissipate.

The DEIS should address the following issues:

The potential for a major oil spill reaching the beaches of Daytona Beach.

The potential for and effects of minor spills and normal operations on Daytona Beach's human, marine and coastal environments.

l. Tourism

The potential impact of oil spills on tourism in North Carolina would be enormous. Recent oil spills on the beaches (from offshore shipping) resulted in people leaving the hotels and motels.

m. Transportation

Will exploration/development substantially increase shipping in North Carolina ports? Can these ports accommodate increased shipping? Are there adequate industrial related facilities (bulk storage facilities, refinery facilities, etc.) to accommodate any increased activity as a result of this proposal?

Where will finished product markets be located and how will it be transported? Will this transportation place any burden/threat on existing transportation facilities? If increased shipping will be a result of the proposal, will this create the potential for collisions and subsequent degradation of the North Carolina coast?

Will increased tanker traffic result in increased oil on the beaches?

What will be problems involved in laying a pipeline from 30 miles offshore into the Cape Hatteras area?

The onshore impacts of pipelines need to be evaluated in the DEIS.

n. Social and Economic Issues

During the exploration stage, will company personnel operate out of cities in North Carolina or be based in North Carolina coastal cities? If so, what cities/towns? How long will the exploration activities last? Approximately how many people will be involved in exploration?

If exploratory staff will be operating/based in North Carolina, what impact will they have on the local housing market? Will exploration be carried on during peak tourist months when, traditionally, housing is at a premium?

What impact will exploratory staff and families have on the local ability to provide social services, such as increased school enrollment, increased fire, police, garbage pickup, etc.?

Will the exploratory staff have any impact on the local labor force?

Assuming exploration reveals developable resources, will the development phase operate out of North Carolina coastal cities? If so, which towns/cities? Approximately how many people will be involved in development activities?

If development staff are based in North Carolina, what impact will they have on the local housing market, the local town's ability to provide social services such as school facilities, water and sewer facilities, fire and police protection?

Will development staff draw on the local labor force? To what extent?

How will exploratory/development activities impact coastal N.C.'s heavy economic dependency on seasonal tourism, sport and commercial fisheries? Shoreline recreation?

If environmental degradation (spills, leaks, etc.) occur during either exploration or development, what impact will this have on the coast's heavy dependency on tourism, sport and commercial fisheries, etc.? What is the potential of environmental degradation to inshore sounds, bays and inlets and the subsequent social and economic implications of such degradation in the sounds, inlets and bays?

Some judgment should be applied to the analysis of socio-economic impacts rather than relying entirely on the Harris model.

There should be an analysis of socio-economic impacts on Georgia in absence of CEIP funding and federal consistency requirements.

What will be the socio-economic benefits to the area compared to the potential environmental impacts of offshore oil/gas development?

The socio-economics of an area should be studied before and after becoming a supply base for offshore oil/gas development.

What will be socio-economic effects of an oil spill on the Daytona Beach tourist based economy?

The socio-economic analysis of North Carolina should consider tourism.

A considerable amount of socio-economic data provided in the previous Sale 43 DEIS covered the inland regional planning areas which are not impacted at all. The DEIS should place more emphasis on the coastal areas.

o. Weather (Severe Storms)

Are nonnegotiable waves (50-100 ft.) considered in the design of oil rigs/platforms? Have there been any studies to determine the frequency of nonnegotiable waves in the U.S. South Atlantic?

The seas are much too tricky for offshore oil/gas development off North Carolina.

The DEIS needs more detailed treatment of tropical storms and hurricanes on the east coast, including the effects on offshore structures of a storm of Camille's strength and analysis of storms prior to 1954.

4. Summary of Atlanta Studies Workshop, November 8-9, 1979

The intent of the workshop was to convey to the BLM Environmental Assessment Division the current status of the BLM funded and related studies in the South Atlantic OCS region. The studies workshop was divided into five discussion groups as follows:

a. Biology

The biology section was attended by the following:

Tom Ahlfeld	BLM, Branch of Offshore Studies, DC
Charlie Barans	S.C. Wild. & Mar. Res. Dept., Charleston, SC
Lee Barclay	F&WS, Charleston, SC
Charles Belin	U.S. Army Corps of Engrs., Savannah, GA
Brad Brown	NMFS, Woods Hole, MA
Stephen Cairns	Smithsonian Institute, Washington, DC
Sarah Deberry	NMFS, Panama City, FL
Robert George	U. of North Carolina, Wilmington, NC
David Gettleson	Continental Shelf Associates, Inc., FL
Mark Grussendorf	BLM, New Orleans OCS Office, LA
Gene Huntsman	NMFS, Beaufort, NC
James Johnston	F&WS, Slidell, LA
Jacob Lehman	BLM, New Orleans OCS Office, LA
Mallory May	Texas Instrument, Dallas, TX
Daniel Odell	BLR - RSMAS, U. of Miami, Miami, FL
Nick Roark	S. C. Wild. & Mar. Res. Dept., Charleston, SC
Reg Rogers	EPA, Atlanta, GA
Ron Sichler	NMFS, Beaufort, NC
Ken Tenore	Skidaway Institute, Savannah, GA
Bob Van Dolah	S.C. Wild. & Mar. Res. Dept., Charleston, SC

The following topics were discussed in the biology section: The South Atlantic OCS Hard Bottoms Study final report is available through NTIS PB-300-821/AS. The primary objective of this study was to determine the efficacy with which standard geophysical equipment and techniques could identify and map hard bottom areas. In addition, the hard bottom substrate and associated fauna were identified and described from dredge samples and color photographs. It was stated that sand waves may give a false indication of hard bottom substrate and there is some interference between the side scan sonar, and subbottom profiler when they are operated together.

The South Atlantic OCS Benchmark Study final report will be available through NTIS in 1980. The objectives of the study were to initiate seasonal studies to determine the concentrations of high molecular weight hydrocarbons and selected trace metals in the sediments and benthic macrofauna; histological studies of selected benthic macrofauna; quantitative seasonal studies of benthic infaunal, meiofaunal, and foraminiferal communities; and enumerate heterotrophic and hydrocarbon-oxidizing microorganisms. The benchmark study was to characterize the Georgia Bight based upon selected sampling regimens. The results of the studies indicated no accumulations of high molecular weight hydrocarbons or trace metals in the water column/bottom sediments. There is an indication that estuarine marsh nutrients are restrained by a nearshore density front and do not reach the mid-shelf region. This is an indication that mid-shelf nutrients are supplied by the Gulf Stream.

The South Atlantic OCS Literature Synthesis final report will be available from NTIS in 1980. The objective of this synthesis is to update the biological, chemical, physical, and socio-economic literature base for the South Atlantic OCS region.

The South Atlantic/Gulf of Mexico Marine Bird Study final report should be available about August, 1980. The objectives of the study are to obtain and organize published and unpublished literature and reports relating to marine birds and discuss potential affects of OCS oil/gas activities on these species.

An Endangered Species Literature Survey (FWS) final report should be available about August, 1980. The objective of this survey is to review and update endangered species accounts for the South Atlantic and Gulf of Mexico regions.

The Atlantic Coast Energy Siting Study final report should be available about September, 1980. The objective of this study is to produce an atlas of the Atlantic coast indicating wildlife species habitat, shellfish beds, national and state parks, and other areas of environmental concern.

National Wetland Inventory maps of South Carolina/Georgia area should be available about August, 1980.

The Sea Island Characterization Study final report should be available about June, 1980. The objective of the study is to summarize existing land use, biological, geological, and socio-economic data for the sea island areas of South Carolina and Georgia.

The South Atlantic and Gulf of Mexico Endangered Species Pilot Study final report will be available about August, 1980. The objectives of this study are to collect and analyze field data on the distribution/abundance of marine birds, turtles, mammals, and manatees; synthesize available data; identify and describe areas of biological significance to these species; and to develop a comprehensive study plan for future studies of these species in the South Atlantic and Gulf of Mexico. A Coastal Endangered Species Study will be funded early in FY 80. The objectives of this study are outlined in the pilot study above. There will be four study subunits, one of which is located in the Merritt Island, Florida area; the other three are located in the Gulf of Mexico region. Also there will be a manatee survey/study in the Jacksonville, Florida area.

The marine mammal stranding network and carcass salvage program in Florida was discussed. Manatee age/size, food, and habitat information is being collected. A manatee management plan for Crystal River, Florida, was also discussed. It was stated that right whales have been sighted close to shore near Ft. Pierce, Florida during January and February.

The MARMAP study supported by NMFS was discussed; the study is intended to examine the regional ground fish population between Cape Fear, North Carolina and Cape Canaveral, Florida, with emphasis on habitat types, i.e., sand bottom, sponge coral, and rocky outcrop communities. The sponge coral communities are extensive off the South Carolina/Georgia border. Not much information is available on benthic algal productivity.

There are about 30 species involved in the commercial fishery in the South Atlantic region, but community relationships are not well understood. About 100 head boats are involved in fishing off North Carolina, South Carolina, Georgia, and Florida with an annual catch of about 2-3 million pounds of fish. Head boat survey data is available from 1972 to present. It was stated there is an accumulation of porpoise and sea turtles near the Cape Lookout area during September.

There are concentrated coral areas off the South Atlantic coast in water depths of 600-800 m, and additional information is required on the deepwater (2000 m) coral areas.

The South Atlantic OCS Living Marine Resources Study has been recently funded. The objectives of the study are to examine the hard bottom areas in the South Atlantic area and compare them with nonhard bottom areas; characterize the fisheries resources and benthic epifauna; investigate the community structure of the hard bottom areas; and determine if current lease stipulations should include other benthic habitat types.

General Comments

(1) Hard bottom areas on the South Atlantic OCS are patchy, not continuous.
(2) There is a considerable amount of data available on plankton and benthic organism from past and ongoing studies in the South Atlantic OCS. However, there was a general concensus that additional nearshore and slope biological studies are needed.
(3) The Georgia Bight is a relatively clean environment with relatively low productivity except in the hard bottom areas.

(4) Nutrients are transported onto the shelf by the Gulf Stream and few estuarine nutrients reach the mid-shelf region.

(5) There is a considerable amount of fisheries data available for the South Atlantic OCS; however, site specific community relationships required additional research.

(6) During the three quarters of 1980 a considerable amount of additional biological, chemical, physical, and socio-economic data will be available for the South Atlantic OCS region.

b. Chemistry Section

The chemistry section was attended by the following:

H. Windom	Skidaway
M. Wade	Texas Instruments
R. Lee	Skidaway
Lynn Griffin	FL DNR
M. Brown	BLM
R. Defenbaugh	BLM

The following topics were discussed in the chemistry section: The history of chemical studies and literature synthesis in the area of concern were discussed. A review of various figures and tables, chosen from the subject literature as examples of material easily and usefully adaptable to EIS texts, was presented. The amount of data, and the evolving hypotheses of chemical processes on the South Atlantic OCS, are significantly improved over the situation which existed for Sale 43.

Additional information was presented concerning trace metal work by DOE. Several other references were supplied by session participants for items of pertinent research not available at the time of the VIMS Literature Update.

General Comments

(1) The really valuable contribution that chemical studies can make does not lie in continued "benchmark-type" work, but rather as a tool in understanding other areas, such as ecological relations and human health. Process studies should be fostered, and the massive data gathering, purely analytical efforts of former studies should not be continued.

(2) The dynamics of trace metal transfer through near-shore systems should be studied and related to offshore sources.

(3) The fate of metals associated with oils introduced into the environment should be studied.

(4) Compounds other than simple hydrocarbons in oil, and their fate in the environment, should be investigated.

(5) Natural degradation processes should be studied in situ, or in simulations closely approximating natural conditions, rather than with isolated oil fractions or with pure bacterial cultures. Fractions resistant to such "natural" attack should then be identified.

c. Geology Section

The geology section was attended by the following:

Jack Rebman	New Orleans OCS Office, BLM
Doug Elvers	New Orleans OCS Office, BLM
Pete Popenoe	USGS - Woods Hole
Karl Oswald	USGS - South Atlantic District Office
V. J. Henry	U. of Ga., Skidaway Institute of Oceanography
Jim Harding	U. of Ga., Marine Extension, Skidaway
Ben Jarvi	USGS, Conservation Division, Washington, D.C.

Jay McCreery U. of Ga., Skidaway Institute of Oceanography
Daniel Foly U. of Ga., Skidaway Institute of Oceanography

The following topics were discussed in the geology section: Two maps entitled "Georgia Bight Benthic Environment from Closed-Circuit TV Video Interpretation" and "Cruise Tracts - GA - GS" were shown. A slide show was presented on live/hard bottoms in the South Atlantic Bight, which were classified into 3 general types based on morphology and occurrence. Type I is classified as low-relief hardgrounds. These features have less than one half meter of relief; may have sponges, gorgonians, etc., attached to them; may be covered by a veneer of sand; and may be very difficult to detect using side-scan sonar. Type II features are moderate relief hardgrounds. They exhibit reliefs of one-half to two meters, generally have generous accumulations of benthic organisms, and can usually be easily identified with side-scan sonar. Grey's Reef is classified as a Type II hardground. The Type III hardground is the shelf-edge reef. This feature occurs in deeper water at the edge of the continental shelf, exhibits relief up to 15 meters, is inhabited by a tropical fauna, and is easily identified on side-scan sonar records. One of the participants indicated a need for a future study to determine the composition of the substrates of the three types of hardgrounds, knowing the composition of these features may give some indication of where they occur.

Recent survey work (late summer-early fall '79) off the Charleston, South Carolina area has revealed 3 sags or small basins in the strata which affect sediments mainly to Oligocene age. These features are oriented northwest-southeast and do not seem to extend beyond the edge of the shelf. They appear larger offshore; however, the largest occurs under Charleston Harbor and has a substantial amount of faulting associated with it. It is suspected that these are wrinkles associated with the Cape Fear Arch. It was also reported that some extensive low-relief hardground were recently found off Savannah. As mentioned previously, this type feature is difficult to detect without TV coverage. One problem is that within 15-20 miles of shore the water is too turbid to see anything with towed TV.

Based on some data obtained, GS has identified some very interesting geological features in the northern part of the South Atlantic Bight. Most of these features occur in slope sediments off the continental shelf edge in deeper water. A short talk was given on the development of the continental margin as we know it today, and gave excellent evidence for the occurrence of hydrocarbons in the area. A large area of bottom erosion was noted in much of the deep water area and has apparently been caused by the Gulf Stream or its counter currents. Geologic cross sections, seismic profiles and maps showing the location and nature of a major growth fault along the edge of the continental margin off North Carolina were also shown. This feature comes to the surface, and has a displacement of one meter only 10 meters below the surface. At depth, the displacement is on the order of several hundred meters. There is also a series of splay faults associated with the growth fault. Another type of faulting was observed and occurs as rotational slumping. These features appear quite common in some areas of steeper slopes. The down-slope creep of sediments appears to be very slow.

One of the most interesting potential hazards identified, and which appear to occur in some of the deeper tracts in proposed Sale 56, are clathrates. These are gas hydrates which are frozen at temperatures between $0^{o}C$ and $40^{o}C$ due to pressure. These features occur in the shallow subsurface and apparently trap gas beneath them. The gas beneath them is in a free state due to the increased geothermal gradient.

Two well developed reef complexes have been identified in the seismic sections. One is of Cretaceous Age and the older is of Jurassic Age. Neither occurs in tracts proposed for Sale 56.

To date, some 22 diapirs have been observed in seismic data just seaward of some of the Sale 56 tracts. These domes were detected on a very broad line-spacing survey, so the possibility is strong that more of these features exist in the area. Good evidence from several sources indicates that these diapirs consist of salt and that the withdrawal of salt from the mother bed may be the partial cause of large growth fault previously mentioned.

One of the needs for future studies identified at the meeting was the need for cores in the vicinity of the Sale 56 tracts, preferably prior to the sale, to conduct studies into the geo-technical properties of the sediments in the area.

USGS-Woods Hole also ran some seismic lines over Red Snapper Sink, a Karst (sink hole) feature located offshore of Crescent Beach, Florida. The hole is roughly 200 feet across, some 434 feet deep, and appears to have originated in the Eocene Ocala Limestone formation. They also noted similar Karst features in the subsurface which have no seafloor expression. Future plans are to run side scan over the area and to lower a TV camera into it.

d. Oceanography Section

The oceanography section was attended by the following:

Larry Atkinson	Skidaway Institute of Oceanography
Susan Bakke	New Orleans OCS Office
Alan Blumberg	Dynalysis of Princeton
Otis Brown	RSMAS, University of Miami
Tom Curtin	North Carolina State University
Carroll Day	BLM, Washington Office
Jim Herring	Dynalysis of Princeton
Ben Jarvi	USGS-CD, Washington, D.C.
Cliff Lataeo	NASA, Wallops Flight Center
Tom Lee	RSMAS, University of Miami
George Mellor	Dynalysis of Princeton
Len Pietrafesa	North Carolina State University
Van Waddell	Science Application, Inc.
Ed Wood, Chairman	New Orleans OCS Office
Kurt Zimmerman	NDBO-NSTL Bay St. Louis, MS

The following topics were discussed in the oceanography section: The Satellite Oceanography Study is producing maps and graphs of sea surface elevation (dynamic height), wave heights, and wind speeds. Maps of surface flow are being produced from the dynamic height data. The draft report will be submitted to BLM during the first quarter of 1980.

All three (3) of the South Atlantic OCS data buoys are in place and collecting data. Combined with the Savannah River Tower (starting January 1980) and coastal airport data, the region will be fairly well covered during GABEX I.

The sea surface data provided by NDBO (through the National Weather Service, NWS) was processed at SAI for use by the PI's and for inclusion into the South Atlantic OCS data base. First year work demonstrated a tendency for run off and tidal flushing to act as a barrier to surface borne material. Second year efforts on shelf surface drift using radio drogues showed the influence of low level winds on the ambient currents. Drogues which became entrained into the Gulf Stream were quick to depart the area.

Hydrographic sampling accomplished as part of the BLM, DOE, and other studies in the region were reviewed, especially the instrumentation of the Savannah River Tower.

The South Atlantic Bight circulation based mainly on current meter information was discussed. The Gulf Stream and its shingles and spin-off eddies are very important to the flushing of the coastal area. The Gulf Stream appears to always be unstable and ready to produce a shingle or eddy. These events occur on a frequency of 2 days to 2 weeks. The outer shelf is dominated by the Gulf Stream while the inner shelf is affected more by wind and tide. Inner shelf tides range to 3 meters. The shelf is generally horizontally stratified in the winter and vertically stratified in the summer. There is a prolonged southward flow on the shelf in the summer (August-September) that apparently is controlled by density and topography rather than winds.

North Carolina State University has made numerous measurements of the density field along the North Carolina coast and will be sampling offshore as part of the BLM program. Very complex circulation patterns exist most of the time off Cape Hatteras where the Gulf Stream deviates offshore. Spin-off eddies are very important in shelf circulation.

Studies in Onslow Bay on a DOE project and later BLM and DOE studies further south of the shelf were discussed. Long-term current measurements have been made off Cape Romain. The results have tied in well with shelf forcing exerted by the Gulf Stream and winds. The affects of topography on the circulation and continental shelf waves were discussed. Topographic features seem to be instrumental in producing Gulf Stream pertubations, e.g., the "Charleston Bump."

Nutrient flux modelling work has been done at Skidaway Institute of Oceanography and North Carolina State University. The shelf circulation is the result of a balance between buoyancy flux stress, wind stress, and Gulf Stream induced stress complicated by semidiurnal tides. The BLM current meter effort for the upcoming year will be combined with DOE effort for a concentrated study of winter-spring conditions in the Georgia Bight (GABEX I). GABEX II is planned for the summer of 1981.

Satellite oceanography work was discussed using very high resolution radiometry (VHRR) to track the Gulf Stream. Deviations from the mean position of the Gulf Stream, spin-off eddies, shingles, and other anomalies are easily followed using VHRR when few or no cloud conditions exist. VHRR is used to direct field sampling and to determine the representativeness of a particular season. Short-term variations will be studies in the third year of BLM field work. RMS of the difference was 0.1°C and the correlation coefficient was 0.89 between ship and satellite data. This is quite good considering that there can be an 8°C temperature difference across the shelf.

Primary productivity estimates were being made through the use of a NASA color scanner which can delineate patches of chlorophyll *a* (phytoplankton). The coastal zone color scanner of NIMBUS 7 is also helpful; algorithms exist to convert the scanner data to chlorophyll *a*.

The Dynalysis model being applied to the South Atlantic OCS region is a 3 dimensional model capable of operating in either a diagnostic or prognostic mode. The resolution of the model is about 25 km x 25 km over the region of 73°W to the shore and 26°N to 37°N. The model outputs for three time scales covering seasonal, tidal and wind events. It handles surface, mid-water and bottom currents, Gulf Stream responses to wind, and meander, eddy upwelling and variation in wind stress predictions. Also covered are temperature and salinity with depth and variation in the mixing depth, high and low mixing zones, magnitude of turbulent mixing with depth, and bottom stress. While accounting for differences in surface elevation, the model responds to heating, cooling, and forcing-surface gravity waves (fast) and internal waves (slow). Initial spin-up of the model required temperature, salinity, and wind data. It uses a sigma coordinate system allowing 21 levels over the entire model. The computer uses 2.7 minutes of time for each data day. The total points for this system are 30x40x21. Atmosphere inputs are wind, heat flux (surface temperature), and evaporation-precipitation data. Oceanic inputs are temperature and salinity along lateral boundaries, velocity along lateral boundaries, estuarine inflow, and temperature and salinity fields for initialization. Concern was expressed about input data, especially for boundary conditions, time, and distance functions. It was stated that bathymetric features tended to steer or torque the Gulf Stream and yet some of these features were rather small; e.g., Frying Pan Shoals is less than 25 km wide. The model will not see features smaller than 25 km and would not resolve meanders of scales less than 25 km. Surface and boundary conditions are needed for the initial spin-up and that much more data is needed from the Blake Plateau.

During the second session of the workshop the discussion concerned trends and conditions definable on the shelf. The Georgia Bight circulation tends to be to the south during the summer and is density driven. During the late summer (September) the surface circulation coincides with the wind patterns; i.e., to the south, especially in the Georgia Bight. Surface (and subsurface) currents are strongly dominated by winds in the winter. From December to March cold fronts on nearly a weekly frequency generate a northward circulation from Cape Canaveral to Savannah. Strong north and northeast winds during the winter set up a southwestward flow off Charleston.

An offshore flow must therefore occur between Charleston and Savannah, probably in the mid-water depths. Very cold Mid-Atlantic water tends to flow southward hugging the shore around Cape Hatteras following cold front passage, sometimes as far south as Onslow Bay.

The flow south of Cape Hatteras tends to be offshore on the surface and onshore on the bottom during the winter season. The opposite trend occurs during the summer months. Cape Hatteras is a

very active area with a major convergence zone located just shoreward of the northernmost Sale 56 tracts.

March starts a period of change in the passage of fronts. The mean current is very weak with the net flow either north or south. The winter-spring transition brings on a warming trend and by late spring there is a strong warming top to bottom.

The Gulf Stream is the greatest forcing agent on the shelf edge. Gulf Stream meanders may be initiated by wind conditions, but the front is not wind controlled. Bathymetry has a large affect on the Gulf Stream; e.g., the Charleston Bump is about 200 m high in about 450 m of water. This causes numerous downstream perturbations. The mid-shelf is wind dominated while the nearhsore is more density controlled.

There is good correlation between winds and bottom currents in the Georgia Bight, better in summer than winter. There is a strong offshore component to surface flow off Savannah in the winter.

Fall is the worst time for winds. They are out of the northeast and set up onshore surface motion with a surface flow to the southwest off the Carolina Capes. In July the winds are to the north and the flow is longshore.

The shelf flushing is on the order of two months with the outer one-third flushing much more rapidly. Onslow Bay is about 50% flushed in 30 days. Flushing is dominated by the Gulf Stream. Its pumping action is a major nutrient source as well as exchanging shelf water.

In discussing drill muds and cuttings it was the general concensus that surface discharge would be better in most cases than to shunt. The surface currents would tend to disperse the material more effectively.

Several other studies are underway in the general region of the South Atlantic OCS region. There is a general lack of flotsum in the Georgia Bight with most tar accumulating on beaches just north of Cape Hatteras and south of Daytona Beach.

Other studies in the area are:

Current Meters & Hydrography '77-78	Phil Richards Randy Watts	WHOI URI
N. Atlantic Gyre Study		NOAA
AXBT Flights		Navy
ART Flights		USCG
Gulf Stream - Satellite Oc.		NASA Goddard

Data gaps include long-term wind data for the shelf; and wind, currents, and hydrography for the Blake Plateau.

e. Planning and Recreation Section

The combined planning and recreation section was attended by the following persons:

Patricia Lee Jerman	Governor's Office, South Carolina
Robert J. Reimold	Director Coastal Resources Division, Georgia Department of Natural Resources
Murice O. Rinkel	Governor's Office, OCS Representative, Florida
James F. Smith	Department of Natural Resources and Community Development, North Carolina
James Johnston	F & WS, Nat. Coastal Ecosystems
Piet de Witt	BLM, Washington
Douglas Elvers	BLM, New Orleans OCS Office
Ed Richardson	"
Mary Bartz	"
Villere Reggio	"
Jack Holt	"

The following topics were discussed in the planning and recreation section: The state representatives suggested that all BLM requests for data and information from state agencies should be channeled through the states' OCS representatives. They all believed that this procedure would assure a more timely and complete response.

Several state representatives expressed the desire to review the visuals for Sale 56 prior to their finalization for printing. It was explained that because of the Sale 56 production schedule most of the visuals were essentially complete and could not easily be reviewed until proof copies are returned from the printer. After discussion of the problems, it was decided that review, if concurred in by BLM management, would be limited to the recreation, endangered species, and commercial fisheries visuals (these are considered most important/sensitive by the states). A tentative procedure was agreed upon, and blueline copies of the data depicted on these visuals was sent to the South Atlantic states for their expedited review.

It was recommended that BLM evaluate the validity of the Oil Spill Risk Analysis, as the analysis probably does not give a reliable prediction of spill dynamics because much of the required site specific input data for the analysis is not available or has not been used.

Both representatives for the states of North Carolina and Florida were interested in obtaining the results of the "scoping" meetings which were held in their states. They were told that a summary of the results of these meetings would be included with the Preliminary Draft Environmental Impact Statement (PDEIS) for Sale 56 which was sent to the states in December, 1979.

The representative from South Carolina suggested that the potential impact of OCS development on unique ethnic/cultural communities located along the coast be considered in the DEIS for Sale 56.

The question was raised whether BLM would answer all the questions and address all the issues and concerns raised at the public scoping meetings. It was indicated that the New Orleans OCS Office would attempt to respond to all significant questions, issues, and concerns in the 56 DEIS.

The state representatives were informed that the forthcoming PDEIS would include: a tentative tract list; a summary of completed, ongoing, and proposed BLM South Atlantic studies; a draft outline of the EIS; the alternatives to be considered; a draft of proposed stipulations; a summary of public scoping meetings; estimated oil and gas reserves; development assumptions and scenarios; and data/information requests. The state representatives suggested that data/information requests be specific as possible, and references to the issues and areas of concern raised during the scoping process. In this regard the state representatives indicated their willingness to cooperate in commenting on the PDEIS and in supplying the requested data/information in a timely manner.

The "Ecological Characterization of the Sea Islands and the Coastal Plain of South Carolina and Georgia" was briefly discussed with emphasis on resource mapping, and particularly the "Atlantic Coast Ecological Survey" which is just getting underway.

No recreation resource specialists attended this workshop session; therefore, procedures and sources of information from the states were discussed as opposed to specific resource information.

5. Increased Study Activity in the South Atlantic OCS Region

With the recent oil/gas industry interest in the North Carolina shelf and shelf break areas, the environmental studies program has been expanded to include these areas.

Five major additions to the FY 1980 studies program are as follows:

a. South Atlantic Slope Slump and Shelf Edge Reef Study

This work will be an addition to the South Atlantic Geohazards Study (MOU-16). A medium range side scan sonar will be used to test the feasibility of mapping shelf edge reefs. In addition, all lease blocks selected for proposed sale 56 (north of 34^oN, except those at less than 100 m) will be studied. The slope slump study will be centered on the lease blocks between 33^oN and 34^oN.

b. South Atlantic Physical Oceanography Wind Transfer Function Study

This study will fill a data gap in the South Atlantic physical oceanography modeling effort. Information is required to describe the transfer of wind energy to the ocean surface. This study will provide that information. The data can be "ground-truthed" with the OCS data buoy network in the South Atlantic. This and other physical oceanography studies will provide input to the oil spill trajectory modeling effort.

c. North Carolina Fisheries Data Study

This work has been suggested by North Carolina through the IPP process (see Section I.E.4.). Several years of data are available for the shelf region, but funding is required for workup and analysis. Our office favors this project but can make no judgment until the proposal is received and reviewed.

d. South Atlantic OCS Living Marine Resources Study (North Carolina Modification)

Three sites off North Carolina are now being considered as additions to this study. The work will be identical to that now in progress for Georgia and South Carolina.

e. South Atlantic Bathymetric Mapping Program

Sixteen bathymetric maps at a scale of 1:250,000 have been printed for the U.S. South Atlantic region. Three additional maps are in preparation by NOAA, National Ocean Survey for the Manteo, Russell, and Marmer areas off North Carolina.

6. Summary Impact Assessment of Major Concerns and Identification of Significant Environmental Issues

This subsection is arranged in tabular format listing the general areas of concern in the first column as determined from resource information, tract nominations and comments, coordination, consultation, public scoping meetings, and the environmental studies workshop.

In column two each area of concern is evaluated as to the degree of expected local/regional impact as a result of proposed Sale 56, utilizing the data base contained in the appendices of this DEIS and the expertise of the New Orleans OCS Office.

Mitigating measures applicable to some areas of concern are indicated in column three and additional mitigation information is in Sections I.C.2. and 3.

The fourth column contains the assessment summary for the areas of concern, and a significance determination of the expected impact as a result of this proposal.

Area of Concern	Degree of Expected Impact* Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
A. BIOLOGICAL ENVIRONMENT				
1. Fish and Wildlife				
a. Amphibians	0	0	Transportation Stipulation and oil spill response measures.	Potential impacts on amphibians from activities resulting from this proposal could occur in coastal areas from facility construction (1-4 services bases, 1-2 storage terminals, 1-2 gas processing plants, and 1-3 pipeline landfalls could result). However, this will be an insignificant local short-term effect.
b. Birds	—/s	0	OCS Orders and oil spill response measures.	Potential impacts to bird species are discussed in the FWS biological opinion in Appendix B and 43 FEIS. The oil spill data in Appendix D indicates 3 expected spills greater than 1,000 bbls and 11-50% probability that if a spill occurs it will contact land within 3-30 days. There would be a localized short-term effect on diving bird species from oil spills.
**c. Endangered Species	—/s	U	OCS Orders, oil spill response measures, and Offshore Oil Spill Pollution Fund.	Potential impacts to endangered species are discussed in the FWS/NMFS biological opinions in Appendix B and the 43 FEIS. Habitat areas for selected endangered species are depicted on visual 3, which may be correlated with figure 5 and table 5 in the oil spill risk analysis in Appendix D. The biological opinions state that the leasing and exploration activities associated with this proposal are not likely to jeopardize the continued existence of the species considered in the consultation or result in the destruction or adverse modification of their critical habitats. However, increased boat traffic in Savannah, Brunswick, and Jacksonville harbors may impact the West Indian Manatee in these areas. Additional discussion on the West Indian Manatee is in Section IV.D.1.b. Production/ development activities as a result of this proposal will require additional Section 7 consultation between FWS and GS.
d. Fish	—/s	0	OCS Orders 2, 5, 7, 8, 9; OCSLAA.	Some minor local impact possible in immediate vicinity of oil spills, but no more than 0.4 spills expected to impact fisheries areas. Routine operations, including discharges into the water are expected to have no significant impact other than minor space-use conflict when fishermen cannot operate where rigs or platforms are located.

* Refers to symbol identification at end of this table.
** Indicates significant issues which are addressed in Sections II and IV of this DEIS.

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
e. Mammals	0	U	OCS Orders and oil spill response measures.	Potential impacts on mammalian species from oil/gas activities are discussed in the biological opinion (Appendix B) and 43 FEIS. Potential oil spills could affect marine mammals and facilities construction could affect coastal mammalian species due to loss of habitat. No significant local impacts have been determined except for manatees and regional impacts on mammals are uncertain. Studies are in progress to determine the effects of oil and noise on marine mammals.
f. Reptiles	—/s	U		Potential impacts on reptilian species (alligators, crocodiles, and sea turtles) are discussed in the biological opinion (Appendix B) and 43 FEIS. There could be a local short-term impact on discrete populations of sea turtles as a result of oil spills along the Georgia barrier islands (see spill analysis, Appendix D). The degree of regional impact is uncertain.
2. Plants				
a. Algae	0	0	OCS Orders.	No apparent negative effects as a result of this proposal.
b. Plankton	—/s	0	OCS Orders.	Some minor localized short-term impact on plankton in the vicinity of drilling activities (see Section IV.D.1.i.). No apparent long-term effects.
c. Vascular plants (1) emergent	—/s	0	OCS Orders and oil spill response measures.	Minor localized short-term effect on emergent plants from oil spills and onshore facilities construction. No apparent regional effects on vascular plants.
(2) submerged	0	0	Same as A.2.c.(1).	
3. Communities				
a. Beaches and barrier islands	—/s	—/c		Potential negative short-term impacts on beaches and barrier islands from oil spills and facilities construction in the Georgia and North Carolina coastal area and some cumulative impacts on a regional basis (see Section IV.D.1.h., Tourism).
b. Estuaries and embayments	—/s/1/c	—/c	Regulation of onshore air emissions and water effluents via the Clean Air Act and the NPDES system of the Federal	Localized short-term, long-term, and cumulative effects from oil spills, effluent discharges, dredging, facilities construction and operation. The oil spill risk analysis model (Appendix D) indicates relatively high risk of oil spills entering coastal inlets in North Carolina and Georgia, but lower risk for inlets in South Carolina and minimal risk for Florida inlets. The greatest risk to North Carolina comes

Area of Concern	Degree of Expected Impact Local	Degree of Expected Impact Regional	Mitigating Measures	Assessment Summary and Expected Impact
b. Estuaries and embayments (continued)			Water Pollution Control Act, as amended. Oil spill prevention via USDI pipeline mapping, EPA Spill Prevention and Control Countermeasure Plan, and USGS OCS Orders. Spill response measures via National Oil and Hazardous Substances Pollution Contingency Plan and USGS-required Operator Contingency Plan. Cleanup costs and damages defrayed by Offshore Oil Spill Pollution Fund.	from production at the nearshore tracts (P3) and transportation through the area (routes T3, T5, T17, and T28). The greatest risks to Georgia are posed by production at shoreward tracts in the southern group (P8, P12, and P13) and transportation through the area (routes T7-13). In general, oil spill impacts will be limited in areal impact and in duration; recovery should occur within a few weeks to a few years, depending on magnitude of the spill and effectiveness of containment/cleanup operations. Dredging and facilities construction, including pipeline emplacement will result in short-term limited area impacts, primarily due to physical disturbances of benthic sediments or construction area. However, impact of pipeline emplacement through marshes may be more severe. Facilities operations may result in chronic discharges which may degrade air and water quality in the vicinity. Impact is not expected to be severe.
c. Marshes and wetlands	—/s/1/c	—/c	Same as A.3.b.	Same as A.3.b.
d. Live bottoms and reefs	0	0	Biological Stipulation; OCS Order 7; Secretarial Suspension Order; DOI permit.	Implementation of the biological stipulation is expected to provide adequate protection for these areas. No significant impact is expected.
4. Ecological Relationships				
a. Biological cycles	—/s	0	Biological Stipulation; OCS Orders 2, 5, 7, 8, 9; OCSLAA, 1978; Secretarial Suspension Order; DOI permit.	Some minor local short-term impact possible in immediate vicinity of oil spills, 3 spills expected from this proposal. Routine operations considered to have no significant impact.
b. Community function	U	0		Uncertain effects on local sites due to lack of data. No apparent regional effects.
c. Community structure	U	0		Same as A.4.b. May be somewhat positive due to increased habitat diversity.

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
d. Foodweb relationships	—/s	0	Physical environment impact prevention/ mitigation same as A.3.b.	Foodweb relationships may be temporarily disturbed by major oil spills, if such spills result in high mortalities of certain prey or predator organisms. Such disruption will probably be of local consequence only, and of short-term duration. No significant long-term impact on foodweb relationships is anticipated.
e. Habitat diversification	—/+/s/1	0	Physical environment impact prevention/ mitigation same as A.3.b. Also via federal, state, or local coastal zone management plans and permitting requirements.	Habitat diversity may be reduced in nearshore areas due to facilities construction. Such construction will be limited in area of impact, but will be of long-term duration. Projected facilities to be constructed as a result of this sale include: operations bases (1-4), occupying 35-300 acres; terminals (0-1), occupying 0-40 acres; and gas processing plants (0-1), occupying 0-75 acres. Habitat diversification offshore will be increased due to the presence of platforms, providing hard substrate throughout the water column and with cutting piles and a certain amount of debris providing low relief substrate or cover in the vicinity of the platform. Baker (1980) and Menzie and Maurer (1980) both report increases in species diversity near production platforms and an exploratory rig drill site, respectively, apparently because of increased habitat diversity.
f. Nursery ground aspects	—/s/1	0	Same as A.3.b.	Impacts on nursery grounds will be primarily due to discharges of onshore facilities and to oil spills reaching the area. Onshore facilities effluents will be regulated by existing federal, state, and local regulations. Oil spills may be prevented from impacting nursery grounds by effective containment actions. Impacts due to spills will be adverse, short-term (few weeks to few years); impacts due to effluent discharges will be long-term, for the life of facility operation.
g. Succession	0	0		No impact on community succession is anticipated as a result of sale related activities.
B. PHYSICAL ENVIRONMENT				
**1. Air Quality				
a. Offshore	—/s	0	Natural dispersive actions.	Offshore air emissions impacts are considered in Section IV.D.1.a. Routine platform operations will result in minor air quality degradation in the immediate vicinity of the platform. Gas blowouts and fires will result in somewhat more severe air quality degradation, but will be of short-term duration. No significant long-term offshore air quality degradation is anticipated as a result of the proposed sale.

Area of Concern	Degree of Expected Impact: Local	Degree of Expected Impact: Regional	Mitigating Measures	Assessment Summary and Expected Impact
b. Onshore	—/1	0	Regulation of onshore air emissions via the Clean Air Act; regulation of offshore air quality via the OCS Land Act, as amended.	Offshore platforms will be sufficiently distant from shore so as to not impact onshore air quality. Onshore terminal/storage facilities contribute only very minor amounts of hydrocarbons through evaporative loss. Gas processing plants may contribute minor amounts of sulfur oxides; the quantities may be minimized through process and engineering considerations. Auto emissions might contribute to significant air quality degradation if all population growth occurs in a single, urban area. Population growth is more likely to be dispersed, however. Local impacts will occur near gas processing plants; no significant long-term regional impacts are expected.
**2. Water Quality				
a. Offshore	—/s	0	Discharge of effluents is regulated by the EPA via NPDES permits. Pipeline permits are handled by the BLM, USGS, and COE. Oil spill prevention, control, and mitigation same as in A.3.b.	Impacts on water quality are considered in Section II.A.2.i. Offshore impacts will stem from discharges of drilling muds, cuttings, deck drainage, sanitary treatment effluents, and produced formation waters. All of these are expected to degrade water quality only in the immediate vicinity of the platform. Severe water quality degradation may occur in the event of an oil spill. Pipeline emplacement may result in suspension of substantial quantities of benthic sediments. Effects are expected to be short-term and of minimal significance.
b. Onshore	—/s/1	0	Regulation of effluents and prevention, control, and mitigation of oil spills same as in A.3.b.	Onshore impacts will include those due to pipeline emplacement and occasional oil spills. Impact due to pipeline emplacement is expected to be minimal and of short-term, although emplacement through marshes may be more severe. Impact due to oil spills will vary from minor to severe, depending on the magnitude of the spill and effectiveness of containment/cleanup operations. Onshore impact from operations bases, terminal/storage facilities, gas processing plants, and existing refineries is expected to be insignificant. Minor impact may occur as a result of increased municipal sewage loads. Onshore water quality impacts will be regulated by State Water Quality Boards under EPA guidelines.

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
C. SOCIAL AND ECONOMIC ENVIRONMENT				
1. Archeological Resources				
a. Prehistoric	U	U/c	Archeological Stipulation.	Assuming invocation of the archeological survey requirement on all leases within the area of high probability for the occurrence of prehistoric sites, impacts to the largely unknown resource base would be avoided or mitigated as far as is currently technologically feasible. Coastal prehistoric sites would possibly be contaminated should an oil spill occur. The most serious impact of hydrocarbon contamination would be its effect on C-14 dates obtained from sites in the impacted area. Physical alteration or destruction of sites may also occur as a result of clean-up operations. This impact is probably not significant since only two spills of greater than 1,000 barrels are projected during the life of the wells developed as a result of his sale.
b. Historic	U	—/c	Archeological Stipulation.	Assuming invocation of the archeological survey requirement on all leases within the area of high probability for the occurrence of shipwrecks, impacts to the largely unlocated resource base would be avoided or mitigated as far as is currently technologically feasible. An exception to this would be the possibility of completely missing the remains of the more than 500 pre-19th century ships known to have gone down in the South Atlantic off the coasts of North Caroline, South Carolina, Georgia, and Florida (SAI, 1979), due to the sampling nature of the magnetometer survey and the relatively small amount of ferromagnetic remains which would be associated with such ships. This would be a significant impact. Coastal National Register sites (see visual 4) such as forts and lighthouses, as well as numerous coastal historic sites not on the National Register, would possibly be contaminated should an oil spill occur. Physical alteration or destruction of sites may also occur as a result of clean-up operations. This impact is probably not significant since only two spills of greater than 1,000 barrels are projected during the life of the wells developed as a result of this sale. Oil contamination would only be a temporary impact to most historic sites.

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
**2. Commercial Fisheries	—/s	0	OCS Orders 2, 5, 7, 8, 9; OCSLAA, 1978; Fishermen's Contingency Fund.	Same as A.1.d. Also, there may be some competition for dock space if a major hydrocarbon discovery is made.
3. Military Warning Areas	0	0	Military Warning Area Stipulations.	Air and water transportation activities are projected to involve 5-7 workboats and 4-6 helicopters. Each workboat may make 2-3 trips each week during drilling operations. Each helicopter would fly an average of one trip each day and 2-3 trips once each week during crew changes. No significant impact is expected as a result of the offshore oil/gas activities (above) and military activities within this region.
4. Recreation				
**a. Recreational fishing	+/l	+/l	OCS Order 1.	Production platforms resulting from this proposal (up to 56 structures) will function as excellent artificial reefs concentrating sport fishes and consequently sports fishermen, especially those structures most accessible to the offshore boating population. Major oil and gas finds in the South Atlantic resulting from Sale 56 will lead to additional leasing interest and could lead to a new recreational fishery (rig fishing) similar to that which exists off the coast of Louisiana. See Section IV.D.1. for a more extensive discussion on the sport fishing impacts of this proposal and its alternatives. We have selected this as a significant issue because of the incidental positive impact and the ongoing controversy between fishing and offshore oil and gas development.
(1) aritificial reefs	0	0		None of the existing permitted artificial fishing reefs will be affected by this proposal.
(2) designated shellfish fishing areas	0	0	OCS Orders 7 and 9; Oil Spill Contingency Fund.	Public use of South Carolina's designated public oyster grounds and state shellfish areas is unlikely to be affected by this proposal. There is almost no chance that short lived oil spills (those most toxic to marine organisms) resulting from this proposal will reach South Carolina's coastal inlets. There is only an 8% chance that any oil spill from the ocean will reach South Carolina's coastal inlets within 30 days, and should this happen it would probably be undetectable on the public shellfish areas.

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
**b. Shoreline recreation	—/s	0	Oil Spill Contingency Plans; OCS Orders 7 and 9; CIPA Grants; L&WCF Grants.	Temporary and minor adverse impacts to a few shoreline recreational areas will result from pipeline landfalls, trash and tar balls, noise and wakes from oil and gas related transportation support needs (crew and supply boats, helicopters), population increases, and oil spills. The level of shoreline recreational use is expected to be unaffected by this proposal unless obvious and extensive oil pollution impacts the shoreline. There is a 50% chance that at least one major spill will reach shore in 30 days. Shoreline recreational areas in North Carolina and Georgia are most vulnerable. The effect of such an event on the level of recreational use would vary depending on the size, duration, season, and specific location of the oil coming ashore. Section IV.D.1.g. provides an expanded discussion on the impacts of this proposal and its alternatives on shoreline recreation. The extensive, concentrated recreational nature of the South Atlantic shorefront and public concern for oil pollution has led us to select shoreline recreation as a significant issue. Section III.C.6., visual 4, and Appendix C provides additional descriptive information on shoreline recreational resources.
(1) parks	—/s	0	Same as C.4.b.	Temporary and minor adverse impacts to a few shoreline parks could result from pipeline crossings (1 or 2), trash or tar ball impacts, or oil spills. Should a major oil spill affect a shoreline park, a more serious impact would result likely to preclude public use and enjoyment of the area temporarily. Although no shoreline parks are likely to be seriously affected by a major oil spill, there is a 19% (winter) to 24% (summer) chance that some park(s) would be impacted 30 days after a major spill (1-3 spills expected). Although some lease site drilling activity may be barely visible during ideal atmospheric conditions from limited areas around Cape Lookout, this is not expected to cause serious public concern for visual amenities. Additional discussion on these impact potentials are included in Section IV.D.1.g.(1) and (2).
(2) wildlife conservation areas	U	0	Same as C.4.b.	Public use of shoreline wildlife conservation areas is unlikely to be affected by this proposal. Even though there is up to a 19% chance that a 30 day old major oil spill (1-3 spills expected) may affect some shoreline wildlife area(s) in the next 25 years should all the

Area of Concern	Degree of Expected Impact Local	Degree of Expected Impact Regional	Mitigating Measures	Assessment Summary and Expected Impact
(2) wildlife conservation areas (continued)				proposed tracts be offered and leased, it is unlikely to have much impact on the overall recreational use of the impacted areas. Some beachfront wildlife appreciation, hunting, or fishing may be temporarily precluded in the worst case situation.
(3) wilderness areas	U	0	OCS Orders 7 and 9.	Established wilderness areas in the South Atlantic region should be unaffected by this proposal. The three wilderness areas with some ocean front exposure (Cape Romain, Blackbeard and Wolf Islands) stand a minor risk (1-4% probability) of being affected by a 30 day old major oil spill (1-3 spills expected). Oil spill cleanup activities may not be allowed in established wilderness areas; therefore, oil washing ashore on wilderness areas will have more lasting impacts or until the natural cleaning mechanisms of the beach and ocean interface has removed, absorbed, or ingested the pollution.
(4) marine sanctuaries	0	0	OCS Orders 7 and 9.	The only established marine sanctuary within the planning area for this proposal is the offshore graveyard of the USS Monitor. The integrity of this historic resource will be unaffected by this proposal. Gray's Reef, under consideration for sanctuary designation, is unlikely to be affected by this proposal even though there is up to a 10% chance a 30 day old oil spill may pass through the area.
(5) estuarine sanctuaries	0	0		It is unlikely that the Sapelo Estuarine Sanctuary will be affected by this proposal. There is a very slim risk (up to 4%), however, that a major oil spill in the marine environment for 30 days could affect the vicinity of the sanctuary.
(6) wild, scenic, or recreational rivers	0	0		None of the specially designated and protected coastal rivers of the coastal plains region, nor those segments of rivers identified for future study as wild, scenic, or recreational rivers, should be affected by this proposal.
**5. Tourism	U	U	Oil Spill Contingency Plans (CAA & OCS Orders 7 and 9); Atlantic Strike Force; Oil Spill Contingency Fund.	No major oil spills associated with leasing the selected 286 tracts are likely to impact South Atlantic tourist beaches; however, there are some risks involved as a result of this proposal. Thirty days after a major spill event (1-3 spills expected) there is a 3% chance that tourist beaches in Florida and South Carolina will be affected, a 12% chance that North Carolina tourist beaches will be affected, and a 19% chance that Georgia tourist beaches will be affected. If the unexpected but possible occurs (extensive, obvious oil pollution

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
5. Tourism (continued)				coming ashore on tourist destination beaches), negative short-term local and/or regional impacts to the tourist economy will result. Oil on beaches and widespread publicity about oil on beaches will cause travelers and visitors to avoid target impact areas and change vacation and travel plans. Ultimately, revenue losses are experienced by tourist-associated businesses within the impacted area(s). Even though Sale 56 would double the likely number of major oil spills offshore (3-6 in the next 25 years), the additional risk to tourist beaches along the South Atlantic seaboard is negligible. In preparing for this EIS, widespread public concern was expressed on how this proposal would affect the South Atlantic tourism industry; therefore, tourism has been selected as a major issue. Additional descriptive information on the tourism industry can be found in Section III.C.7., and Section IV.D.1.h. provides a broader discussion on possible impacts of this proposal and its alternatives on the tourist economy.
6. Employment a. Exploration and development phases	+/s, —/s, 0/l	+/s, —/s 0/l		Short-term increases in local and regional employment with potential to reduce level of unemployment. Local hire job opportunities peak at between 211 and 266 during the exploration phase, and between 1,092 and 4,417 during the development phase depending on the development scenario. After the development phase, peak local OCS related employment will experience a rapid 2 year decline until stabilizing under the influence of the growth in production phase employment. See comments under local fiscal balance, C.9., below.
b. Production phase	+/l	+/l		Long-term (10-15+ years) increase in local hire employment ranging from 325 to about 1,350 depending on the development scenario. This type of employment should contribute to the economic well-being of the area or areas in which it is located; however, see comments on local fiscal balance below.
7. Population Change (new resident population)	U/s, 0/l	0		New resident population will be generated in direct proportion to the amount of new resident employment which occurs in each onshore development area. The maximum (peak) new resident population generated by the Northern Tract Group development scenarios ranges from 925 low resource estimate (LRE) to 3,083 high

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
7. Population Change (new resident population) (continued)				resource estimate (HRE), and is assumed to be located in the Wilmington-Southport and/or Morehead City areas. The maximum (peak) new resident population generated by the Southern Tract Group scenarios ranges from 1,166 (LRE) to 3,681 (HRE) and is assumed to be located in the Georgetown, Charleston, Savannah, Brunswick, and/or Jacksonville areas. Analysis of new resident population average annual growth rates for the potential onshore development areas indicates that, on the whole, none of the development areas would be subjected to excessively high rates which would strain the area's ability to provide public and private services. The Morehead City and Brunswick areas would experience the highest growth rates: 0.6% (LRE) to 2.2% (HRE), and 0.5% (LRE) to 2.1% (HRE). But these estimates are well below the 10% rate which has been found to create a strain on a community's ability to provide local services. These amounts are not meant to preclude the possibility of problems arising in the fiscal balance of certain communities — see comments on local fiscal balance below.
**8. Community Services and Facilities	U/s, 0/l	0	Regional and local impact management planning and coordination; CEIP assistance; state coordination and assistance.	New resident population and business activity will result in increased demand for public and private community services and facilities. Such increases could cause temporary deficiencies and reductions in the quality of service. The severity of these potential deficiencies is assumed to be directly proportional to the total increase in demand and the period of time over which the increase occurs, and inversely proportional to the capacity of existing service systems and facilities to provide for increased demands without lowering service standards to the point where the level of service is considered unacceptable to the public. Also, see comments on local fiscal balance below.
a. Education	U/s, 0/l	0	Same as C.8.	Educational enrollment is estimated to increase from 402 (LRE) to 1,323 (HRE) under the Northern Tract Group sceanrios, and from 493 (LRE) to 1,545 (HRE) under the Southern Tract Group scenarios. Locational distribution will be the same as for new resident population. Providing for this additional enrollment is not expected to present unusual problems since public education is a county-wide responsibility with significant state and federal assistance available on a per pupil basis. Furthermore, there are adequate short-term methods for coping with facility crowding (e.g., temporary classrooms).

Area of Concern	Degree of Expected Impact		Mitigating Measures	Assessment Summary and Expected Impact
	Local	Regional		
b. Water supply	U/s, 0/l	0	Same as C.8.	Water usage will increase at an assumed rate of 100-180 gallons per day for each new resident. The total increase in demand will, in most cases, be relatively small and should not strain the water systems in the larger municipalities which generally try to maintain a sufficient amount of excess capacity to provide for unanticipated growth and demand situations. However, the actual effect on specific systems during the period 1987-1992 when the maximum increase in demand is expected to occur is very difficult to predict.
c. Sewage disposal and solid waste management	U/s, 0/l	0	Same as C.8.	The amount of sewage will increase at an assumed rate of 100-120 gallons per day for each new resident, and the quantity of solid wastes will increase by 6 pounds per day for each new resident. The management of the additional relatively small amount of solid wastes should not pose a significant problem in any of the development areas. However, the effect that the increased amount of sewage might have on a particular system is, as in the case of water supply, impossible to predict at this time. It should be noted that sewage treatment facilities are often at or near capacity, particularly in smaller communities, and many such facilities need to be brought up to federal water quality standards.
d. Transportation/ traffic	U/s, 0/l	0	Same as C.8.	OCS generated activity and population will result in additional truck and other vehicular traffic which could contribute to congestion at certain locations. The estimated levels and geographic distribution of OCS generated activity are unlikely to cause a significant adverse impact.
e. Housing demand	U/s, 0/l	0	Same as C.8.	Increased demand for housing will be directly proportional to the increase in new resident employment in each development area. Total additional demand for the Northern Tract Group scenarios ranges from 396 (LRE) to 1,337 (HRE), similarly for the Southern Tract Group scenarios it ranges from 511 (LRE) to 1,625 (HRE). Its locational distribution will be the same as described for new resident population above.
9. Local Fiscal Balance	U/s, 0/l	0	Same as C.8.	Increase in local and regional business activity, population, property values, income, and housing generated by the proposed OCS sale will cause public revenues to increase. At the same time, expenditures for public services and facilities will rise in response to increased demands engendered by OCS related economic activity and population

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
9. Local Fiscal Balance (continued)				growth. Fiscal impacts generated by the proposed OCS activity will vary by phase, by type of onshore activities/facilities, by the size of the community impacted, and by category of public service. While revenues generated by OCS onshore activities are generally sufficient over the long-run to cover expenditures, there could be a lag between the time that service needs arise (the beginning of onshore impacts) and the time at which taxes imposed on new onshore activities/facilities begin to produce significant revenue. The gap by which revenues "lag" increased service demands may cause severe problems for smaller communities. There may also be imbalance between the communities in which the OCS generated industrial activites/facilities are located and the communities in which the new residents reside, if different. In addition, the temporary nature of the peak demands could create special scheduling and financing problems. The ultimate impact of OCS generated activities, development, new population and increased service demands will be significantly affected by the planning and prevention measures undertaken at the federal, state, regional, and local levels. One of the best ways for dealing with fiscal (and other) impacts of OCS development is to anticipate, plan for, and mitigate potential impacts. All of the potential onshore development areas either have or participate in local and/or regional planning programs; in addition, the entire coastal region is included within state coastal management programs. The objectives of these programs include orderly and efficient growth management which minimizes fiscal, social, and environmental impacts. Discussion with planners within the region indicates that the moderate levels of growth estimated for the proposed project should be within the planning and management capabilities of the local areas to prevent or largely mitigate peak fiscal impacts. These opinions assume active participation in, and coordination with, the various federal and state financial assistance programs. In this regard, the Coastal Energy Impact Program, in which state and local governments receive federal assistance in planning fiscal impacts, should be an important mitigating factor.

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
10. Land Use	0	0	Regional and local land planning and development regulations; environmental regulations; federal consistency requirements.	The amount of land and marginal wharf required for temporary service bases could be provided without causing significant conflicts or competition with other port and harbor activities in the potential onshore development areas. The amount of land and marginal wharf required for long-term usage as operations bases is considerably greater than that required for temporary service bases and may result in full utilization of dockside land in some ports, and require the development of additional land and marginal wharfs in other ports. Total land requirement for other OCS oil and gas activities/facilities are relatively small (240 acres). It is assumed that these facilities will be located and constructed in accordance with local land use, environmental, and other regulations so that land use conflicts or competition problems will be minimal.
11. Marine Transportation				
a. Ports	+	0		The ports utilized for OCS-related activities could receive a positive economic benefit by the increased usage of land and facilities which may be vacant, under-utilized, or marginally used.
b. Shipping traffic and navigation	—	—	Coast Guard Aids to Navigation Regulations.	Increased ship traffic (small supply and survey vessels, and pipeline barges) in harbors and offshore areas, particularly during exploratory and development phases, could cause minor negative impacts by increasing the collision hazard and making navigation of larger ocean-going vessels more difficult. Additional hazards to navigation would result from the presence of offshore structures on the OCS during all phases, from exploratory drilling to production. No navigational "fairways" (such as those in the Gulf of Mexico) are established for the South Atlantic offshore region.
12. Social Conditions				
a. General	U/s, 0/l	0/s, 0/l	State and local impact management planning; social service programs.	A large number of transient workers and rapid increase in new resident population (inmigration), plus the concomitant inflow of additional money into a community could result in, or contribute to, social dislocations such as new resident adjustment stress, intergroup conflicts, vice and crime, and psychological insecurity. The nature and severity of such social dislocations are difficult to predict; however, with respect to the proposed sale, they are expected to be susceptible to mitigation and not to pose a significant problem-see comments on local fiscal balance above.

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
b. Unique ethnic/ cultural communities	U	NA		Information provided by the states (including CZM plans) and other information retrieved through library searches did not conclusively indicate that these communities would be impacted by the oil and gas development assumptions compiled for this sale. The communities are rapidly being assimilated into the surrounding communities, primarily due to ever-increasing land development. These findings were discussed with state representatives prior to the development of this DEIS.
D. OTHER CONCERNS				
1. Alternative Energy Conservation	NA	NA		The DOI published an FEIS on its 5-year OCS oil and gas lease schedule for the years 1980-1985, in which alternative energy sources were addressed, including conservation. For that reason, it was not fully documented in this DEIS. Although a national priority has been set to reduce the amount of oil imports through a combination of increased domestic production and of alternative energy sources, it is not technologically or economically feasible at the present time to substitute a significant amount of other energy sources to aid in this overall reduction. A significant problem deals with the amount of energy used to produce alternative energy from these sources. Each has inherent problems which must still be overcome. Solar energy uses the least amount of energy in its development, but conversely utilizes large land areas which may cause other environmental problems. Nuclear power plants currently require 12-14 years time to bring the plant on line. Conservation depends on the willingness of the American people to institute this measure. To date there has been a small measure of success in this area, which has helped decrease the steadily rising trend of increased oil imports. Until solutions are forthcoming, oil and gas development appears to be the most viable alternative.
2. Engineering Problems (deepwater)	0	0	30 CFR, Part 250 gives the Supervisor, USGS, the authority to regulate oil and gas and sulphur operations in the OCS. GS also has a Platform	Concern has been expressed by EPA that GS does not have enough authority to regulate deepwater operations. Concern has also been expressed that the technology does not exist to drill in water depths found in the deepwater tracts in this sale, especially in current flow conditions of the Gulf Stream. Industry does, at present, have the capability to drill in more than 2,400 m, and the deepest tracts in Sale 56 are in some 2,100 m. Several wells have been successfully

Area of Concern	Degree of Expected Impact Local	Regional	Mitigating Measures	Assessment Summary and Expected Impact
2. Engineering Problems (deepwater) (continued)			Verification Program. Under the provisions of OCS Order 2, GS reviews, along with BLM, FWS and the affected states, and approves all exploratory plans and development plans. This review process assures that adequate technology is used for a particular site.	drilled worldwide in currents of the same magnitude as the Gulf Stream, using equipment and procedures specifically designed for the conditions at the sites. The same equipment and procedures will be partially to totally applicable to the tracts in Sale 56 which occur in the axis of the Gulf Stream (for additional information, see Appendix I).
3. Noise	—/s/1	0		Some concern has been voiced regarding effects of noise from offshore drilling or other operations on marine mammals. No clear evidence exists to indicate an adverse impact on marine mammals, other than simple avoidance (or attraction). A current study, administered by the New York OCS Office, addresses this topic. Human public health noise concerns will be of significance only in the immediate vicinity of the various facilities constructed.
4. Oil Spills	—/s/1/c	0	Same as A.3.b.	Oil spills are the most serious threat to the environment as a result of the proposed sale. Prevention, control, and mitigation of spills is considered in Section I.C.3.; causes of oil spills are considered in Section IV.C.1.; and impacts of oil spills are considered in Section IV.D.1.i. (summarized in Section II.A.2.i.). Probabilities of oil spills occurring and impacting various coastal areas is considered in Appendix D.
5. Weather-Tropical Cyclones	—/l	+/s	Engineering design of offshore structures-site specific	Equipment used offshore is designed to withstand severe storms as well as the theoretical cataclysm or 100-year storm. The considerable investment for an offshore structure requires great care in design, construction, and installation. Water depth, wave conditions, and geotechnical properties of the soil at the specific location are considered for every platform as a separate structure. Therefore, it is significant in that the petroleum industry must operate safely in a hostile environment while finding, producing, and transporting oil from offshore wells.

Symbols used for degree of expected impact:

++	Very positive impact
+	Somewhat positive impact
0	Neutral or negligible impact
—	Somewhat negative/adverse impact
— —	Very negative/adverse impact
U	Uncertain
s	Short-term effect (less than 3 years)
l	Long-term effect (greater than 3 years)
c	Cumulative effect
NA	Not applicable

APPENDIX G

PROTECTION OF CULTURAL RESOURCES
RELATED TO MARINE OIL AND GAS OPERATIONS

APPENDIX G

COOPERATIVE PROCEDURES
BETWEEN THE
U.S. GEOLOGICAL SURVEY (USGS) AND THE BUREAU OF LAND MANAGEMENT (BLM)

PROTECTION OF CULTURAL RESOURCES
RELATED TO
MARINE OIL AND GAS OPERATIONS

In recognition of the need for cultural resource protection on the OCS where GS is responsible for the managment of offshore oil and gas operations on lands where BLM is the responsible surface management agency, BLM and GS have concluded that:

1. Compliance with the Historic Preservation Act of 1966, as amended, the Archeological and Historic Preservation Act of 1974, Executive Order No. 11593, other legislation, and policy directives regarding protection of cultural resources is mandatory for both agencies.
2. There is a need for long-term management continuity for cultural resources and cultural resources should be considered in all aspects of planning and policy decisions.
3. There is a need to insure that cultural resources are not inadvertently injured or destroyed by oil and gas operations and related activities.
4. There is a need to achieve consistency in the application of cultural resource requirements and stipulations related to marine oil and gas operations.
5. There is a need for a uniform approach to cultural resources identification and protection and for interface procedures between BLM and GS that will permit timely and orderly exploration and development of oil and gas resources on the Outer Continental Shelf (OCS).
6. Substantial delays and conflicts based on protection of cultural resources can be kept to a minimum if proper protection of cultural resources can be accomplished.

Therefore, BLM and GS mutually agree that:

1. The procedures outlined herein are intended to supplement the Cooperative Procedures Agreement of August 1975, but in case of any conflict or inconsistency therewith, the provisions of this agreement shall prevail.
2. Prior to the injury of cultural resources, mitigating measures shall be implemented at a level commensurate with the significance of the resource.
3. Consideration for protection of cultural resources will be given priority over mitigation of impacts.
4. Because BLM has the primary responsibility for resource management of Federal offshore lands, including cultural resources, and because BLM has cultural resource expertise, GS will rely on BLM to provide documentation identifying the possible existence of cultural resources that may be affected by operations conducted on offshore oil and gas leases and to review and comment on cultural resource reports, assessments, and protective measures.
5. Because GS has the primary responsibility for the management of operations conducted on oil and gas leases on the OCS and because GS has the geological and geophysical expertise necessary to determine the feasibility of detecting by remote sensing, possible cultural resources identified by BLM or other knowledgeable sources, GS will notify the lessee when the provisions of the cultural resource stipulation are to be implemented.

In furtherance of the general concepts listed above, the following interface procedures will be followed to assure cultural resource protection in relation to oil and gas operations proposed on offshore leases over which BLM and GS exercise joint responsibilities:

LEASE OPERATIONS

1. BLM will include in OCS oil and gas leases a standard stipulation for the protection of cultural resources with the understanding that:

   a. GS will implement the provisions of this stipulation whenever BLM or other informed source provides documentation that a cultural resource may exist on a lease and the nature of the resource is such that it can be detected by means of a remote sensing survey. Appropriate documentation includes, but is not limited to, probablistic studies and archival research.

   b. When GS receives documentation from BLM or other informed sources that a cultural resource may exist on a lease and determines that the nature of the resource is such that it may be detected by a remote sensing survey, it will require the lessee to conduct such a survey, as specified in a current Notice to Lessees (NTL) on cultural resources, to determine the potential existence of any cultural resource that may be affected by any operation on the lease.

2. GS shall require the lessee to have data from any remote sensing surveys conducted for cultural resource investigations, examined by a qualified marine survey archeologist to determine if indications are present suggesting the existence of a cultural resource that may be adversely affected by operations on the lease. The report of this survey and assessment shall be submitted simultaneously to GS and BLM for review.

3. If cultural resource indicators are present, the GS shall require the lessee to locate any proposed operation so as not to adversely affect the indicators identified or to establish on the basis of further archeological investigations that a cultural resource does not exist where indicated.

4. In the event that, as a result of an archeological investigation, the presence of a cultural resource is sufficiently established to warrant protection and the proposed operation cannot be relocated, GS shall require the lessee to take no action that may result in an adverse effect on the resource until instructions are received as to its disposition.

5. GS shall inform BLM of the proposed disturbance of the resource. BLM will advise the lessee through GS within five (5) working days as to the disposition of the resource to be affected.

6. In the event of discoveries of cultural resources as the result of approved oil and gas operations, the following actions shall occur:

   a. The lessee or operator shall notify GS of cultural resource discoveries.

   b. GS shall immediately notify the BLM of such discoveries.

   c. The BLM will evaluate the discoveries of cultural resource brought ot its attention by GS and will determine, within five (5) working days of being notified, what action will be taken with respect to such discoveries. Appropriate mitigation shall be undertaken prior to proceeding with any operations that might be destructive to the discovery. The responsibility for and cost of investigation and mitigation of such values discovered during operations will be that of the lessor.

7. The provisions of this agreement shall be reviewed at least annually.

George L. Turcott
Associate Director, BLM

W. A. Radlinski
Acting Director, USGS

3/17/78
Date

3/17/78
Date

APPENDIX H

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES IN THE ATLANTIC OCS

[illegible]

1. BLM will [illegible] oil and gas leases [illegible] for the protection of cultural resources [illegible]:

a. [illegible] of [illegible] BLM or other informed source [illegible] that a cultural resource may exist on a lease and the nature of the resource is such that it can be detected by means of a remote sensing survey. Appropriate [illegible], but is not limited to, [illegible] studies and cultural [illegible].

b. When [illegible] from BLM or other informed sources that a cultural resource may exist on a lease and determines that the nature of the resource is such that it can be detected by a remote sensing survey, it will require the lessee to conduct such a survey, as specified in a Notice to Lessees (NTL) on cultural resources, to determine the potential existence of any cultural resource that may be affected by any operation on the lease.

[illegible] the lessee to have data from any remote sensing surveys conducted for cultural [illegible] by a qualified marine survey archaeologist to determine if indications are [illegible] of a cultural resource that may be adversely affected by operations on the lease. [illegible] and BLM for review.

[illegible] the lessee to locate any proposed [illegible] on the basis of further archaeological [illegible] that a cultural resource may be adversely affected.

[illegible] on the basis of archaeological investigation, the presence of a cultural resource [illegible] the proposed operation cannot be relocated, [illegible] no action that may result in an adverse effect on the resource until instructions [illegible].

[illegible] of the proposed disturbance of the resource, BLM will advise the lessee [illegible] the disposition of the resource to be affected.

[illegible] of cultural resources as the result of approved oil and gas operations [illegible]:

a. [illegible] of cultural resource discoveries.

b. GS [illegible] notify the BLM of such discoveries.

c. The BLM will evaluate the discoveries of cultural resources brought to its attention by GS [illegible], within five (5) working days of being notified, what action will be [illegible] to such discoveries. Appropriate mitigation shall be undertaken prior to [illegible] that might be destructive to the discovery. The responsibility [illegible] of investigation and mitigation of such values discovered during operations [illegible].

2. The provisions of this agreement shall be reviewed at least annually.

George L. Turcott
Associate Director, BLM

W. A. Radlinski
Acting Director, USGS

[illegible]
Date

3/17/78
Date

APPENDIX H

NOTICE NO. 78-2

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES IN THE ATLANTIC OUTER CONTINENTAL SHELF

Minimum Requirements for Site Surveys

I. Introduction

Exploratory operations on Federal OCS oil and gas leases must be assessed to ensure that they are conducted in an operationally sound manner which will minimize environmental impacts. The Code of Federal Regulations, Chapter 30, Subpart 250.34 requires that an operator describe environmentally sensitive or potentially hazardous areas which might be affected by the proposed exploratory activities. Further, Atlantic OCS Orders No. 2 require that applications to drill include environmental conditions expected. Certain surveys and interpretations are necessary to support such descriptions for specific sites. Additional survey requirements may be imposed by lease sale stipulations. This Notice is effective for all leases in the Atlantic OCS Area.

II. Surveys and Interpretations

Surveys which include various remote sensing techniques may be conducted that will form the basis for interpretations that evaluate the existing environmental conditions. Interpretations which may indicate the presence of certain hazards or resources are required for all lease tracts while other interpretations are required by lease terms for only specifically identified lease sale areas, tracts or sites. Previous identification of hazards or resources through the EIS process, assessment of preliminary surveys or studies conducted by other parties may require verification of the presence or delineation of the extent of the hazard or resource by a site intensive survey. This intensive survey may include remote sensing techniques not previously utilized.

A. General Requirements

The following requirements will apply to all site surveys conducted under the provisions of this Notice.

1. Area extent - Unless otherwise specified by the Supervisor, surveys other than biological must completely encompass the proposed area of operations and will include a margin of 300 m radius beyond the farthest anchor scope or structure. Biological surveys will be required to encompass an area as provided in II.B.(2)(c). Surveys which include an entire tract(s) may be conducted in lieu of individual site surveys. Lessees holding adjoining tracts may conduct joint surveys encompassing such tracts.
2. Position verification - Inaccuracies inherent in real time navigation systems necessitate verification against an independent reference. Until there are fixed structures located in or near the point of measurement, verification must be obtained through comparisons of range-range or hyperbolic systems to satellite doppler navigation fixes. During site survey and vessel positioning operations, at least 10 such fixes shall be made. The mean value of such comparisons may not exceed 75 m and the maximum value may not exceed 150 m. Each of these fixes must be supplemented with an accurate determination of velocity of the vessel positioned. The error analysis for such comparisons must be recorded and submitted as auxillary documentation for each fix.

B. Surveys

The preliminary surveys required will be conducted on a grid spacing of 300 m by 600-800 m when required for geologic hazards alone. When an interpretation for cultural resources is required, the spacing shall be 150 m by 600-800 m. Magnetometer surveys shall be as provided in II.B.2.a. The grid spacing for other interpretations, such as "live" or hard bottoms, will be addressed in the appropriate supplement to this notice, or on a case-by-case basis. Where the image quality is poor, resurvey may be required, unless it is demonstrated that local conditions preclude obtaining a better image under the parameters specified in this Notice.

1. Preliminary - The following surveys shall be conducted prior to exploratory operations on all Federal OCS oil and gas leases.
   a. Bathymetry - Determination of water depth by instrumental methods calibrated to within ½% of water depth and based on speed of sound data for the entire water column for the season of the survey. Bathymetry must be conducted in conjunction with each site survey required under this Notice or lease stipulation.
   b. Sea floor imaging - Side-scan sonar dual coverage continuous recordings to 150 m each side from not higher than 30 m above the bottom.
   c. Sub-bottom profiles - Profile recordings of seismic reflections to a depth of 30 m below the sea floor with resolution of one millisecond or better, is required on all lines.
   d. Seismic profiles - As a minimum, single trace sparker surveys over the entire lease tract are required, supplemented with three east-west and two north-south CDP sparker lines around each proposed site as follows: 12 or more channels, continuous reflection profiles clearly recording primary reflections to 0.5 seconds (two-way travel time) with resolution of five milliseconds or better; this CDP data shall be processed through 12 fold stack deconvolution, controlled gain and normal automatic gain control. Alternatively, the 12 fold digitally processed CDP sparker lines may be submitted for the entire tract. An analog monitor of the near-trace record shall be maintained using a 19-inch flat bed dry paper recorder. A time-depth curve constructed from seismic velocities derived from multichannel velocity scan analyses or seismic refraction data shall be submitted with each report. In the absence of any such data, an assumed velocity must be justified by argument from regional or geological information.
2. Supplementary
   The following surveys may be required for an entire lease area, individual tracts or specific sites. The survey grid for these supplementary surveys will be generally on a tighter grid and will be specified on a case by case basis if not given in this Notice.
   a. Magnetometer - Spacing of 75 m is required with cross line spacing not to exceed 500 m when this survey is conducted for the detection of munitions, and 150 m by 600-800 m when conducted for cultural resources. Tuning of the magnetometer and towing depth of the sensor shall be set to obtain optimum sensitivity levels. Towing depth of the sensor shall be measured and recorded for each line.
   b. Visual observations - One or more of the following may be required. These observations will usually be required in verification of previous indications of a given resource or hazard.
      1. Videotape recording of television images of the seafloor, the immediately overlying water column and/or associated marine biota.
      2. Still photography, color and/or black and white as specified in b. (1) above.
      3. Direct visual observations from submersibles or by divers.
   c. Biological survey - When required, details will be defined under a Notice to Lessees specific to the biological habitat or populations. In general, the survey will consist of one or more of the following:
      1. Visual observations

2. Faunal samples including baited traps and lines, or drags, dredges, grab samplers, etc., as appropriate
3. Trawl samples
4. Plankton tows
5. Sediment grain size analysis

d. Physical sampling - The following sampling methods and/or others may be required in verification of previously identified hazards or resources, or for surveys for specific projects such as emplacement of a sub-sea structure. These sampling surveys would be tailored to the extent and nature of the hazard, resource or project. These special purpose sampling programs would normally consist of one or more of the following:

1. Drags, dredges or sleds
2. Grab or snapper samples
3. Cores
4. Water column samplers
5. Tows utilizing appropriate trawls, plankton or other nets
6. Current surveys, scour studies and other engineering studies relative to siting of seafloor structures

C. Interpretations

One or more of the preceding surveys will be used in the following interpretations to evaluate the proposed site for the specified hazard or resource. As in the case of the surveys, certain interpretations will be required for all lease areas and tracts, while other interpretations will be required only by lease sale stipulations. Each of these interpretations must be performed by a professional competent in the appropriate field.

1. Preliminary - These interpretations will be done for all leases in the Atlantic OCS.

Geologic hazards - Interpretation of bathymetry, side scan sonar, sub-bottom and shallow seismic profiles shall be analyzed, as a minimum, for bottom instability, faulting and shallow gas.

2. Supplemental - These interpretations will be performed as required by specific lease stipulations and/or when applicable, invoked by the Supervisor.

a. Cultural resources - Analysis of bathymetry, side-scan sonar, sub-bottom profiles and, if appropriate, magnetometer surveys may be required for the presence of shipwrecks, dwelling sites or other historical or archaeological resources.

b. Munitions - Analysis of side scan sonar, sub-bottom profiles and magnetometer surveys may be required for indications of the presence of unexploded ordnance, such as munitions, mines or bombs.

c. Structures - Structures, other than well-head assemblies and completions, will require various studies to define the engineering properties of the proposed site, such as compaction tests of sediment samples and scour studies.

III. Anomalies

When an initial assessment of the foregoing surveys and interpretations indicates the presence of the resource or hazard or the presence is previously known, the Supervisor will require that one or more of the following steps be taken:

A. Resurvey

Where the limits of the resource or hazard cannot be adequately defined by interpretation of the preliminary surveys, a resurvey on tighter grid spacing of the resource or hazard or a survey of the area using different methods such as photo documentation may be required. The spacing, number of samples and other parameters would be prescribed by the Supervisor on an individual basis. If it is

demonstrated that the resource or hazard suggested by the preliminary survey does not, in fact, exist, no further surveys or operational restrictions will be required.

B. Avoidance of the Resource or Hazard

If the extent of the resource or hazard can be defined from the preliminary or subsequent surveys, the site may be relocated to avoid it.

C. No Effect

If the lessee or operator can demonstrate to the Supervisor that the proposed operation will neither endanger the resource or the hazard nor affect the safety of the operations or the environment, no further surveys or operational restrictions will be required.

IV. Reports

A. Summary Report

A summary report of the survey conducted and analyses of the required data, as a minimum, shall be prepared by analysts professionally competent to evaluate the data for the planned operations. These authors shall be identified and shall sign the report. A copy of this summary report shall be submitted prior to or with each copy of the Exploratory Plan to the District Supervisor.

B. Maps

All maps and data pertaining to the surveys must be submitted in triplicate for review. The following maps shall be submitted for each area, tract or site survey:

1. Bathymetry
2. Shallow structure (primary reflecting horizon)
3. Geologic Hazards, including bottom instability, faulting and shallow gas deposits
4. Post plot, showing survey lines, sampling stations and navigation fix locations.

These maps must be prepared at a scale of between 1:4,000 and 1:12,000 on a base showing the lease boundaries, geographic coordinates and any other coordinates used in positioning. Fixes and location shall be clearly identified on the map and legend, and shall be correspondingly identified on data recordings and interpretations, and in text references.

C. Survey Traces

Copies are acceptable (continuous flow microfilm reduced not more then 20:1 from originals), but original data may be requested if the quality of the copy is poor. The following special submittal requirements pertain to each survey specified:

1. Full size paper copy - seismic profiles
   a. Single trace sparker
   b. 12-fold CDP processed sparker
2. Microfilm or paper copy
   a. Bathymetry
   b. Sub-bottom profiles
3. Microfilm or original side scan sonar

V. Cancellation

Mid-Atlantic Notice to Lessees No. 76-2, dated December 20, 1976, Subject: Minimum Requirements for Operations Site Survey; Mid-Atlantic Notice to Lessees No. 76-3, dated December 20, 1976, Subject: Minimum Requirements for Navigation or Positioning Confirmation and Mid-Atlantic Notice to Lessees No. 77-4, dated July 20, 1977, Subject: Minimum Requirements for Undetonated Devices Geophysical Survey are superceded by this Notice. This Notice remains in effect until superceded or cancelled.

December 1, 1978
Effective Date

William S. Cook
William S. Cook
Acting Atlantic Area Oil and Gas
Supervisor for Operations

November 30, 1978
Approved

Hillary A. Oden
Hillary A. Oden
Acting Chief, Conservation Division

NOTICE NO. 78-2 SOUTH ATLANTIC SUPPLEMENT 1

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES IN THE SOUTH ATLANTIC OUTER CONTINENTAL SHELF

Minimum Requirements for Hard or "Live" Bottom Surveys

I. Introduction

OCS Lease Sale Notice No. 43, which appeared in the Federal Register, Volume 43, No. 36, pages 7373-7378, includes a stipulation requiring interpretation of surveys for the presence of "live" or hard bottoms. This stipulation applies to each lease issued in the South Atlantic area.

II. Surveys and Interpretations

This supplement to the basic Notice to Lessees 78-2, implements the specific requirements to be performed on site surveys for all leases issued and all work performed under those leases in the South Atlantic District.

A. General Requirements

The general requirements of Notice to Lessees No. 78-2 apply to these surveys with the following additional requirements:

(1) Area extent - The survey area shall encompass an area included by a radius of 1820 m about the center of the site.
(2) Grid spacing - The survey shall be conducted on a grid spacing of 150 m by 600-800 m.

B. Surveys

(1) Preliminary - As required in Notice to Lessees No. 78-2 less the shallow seismic profile
(2) Supplementary - If interpretation of preliminary surveys indicate the presence of a "live" or hard bottom, the Supervisor may require the following additional surveys to be conducted:
    (a) Visual observations
        i. Videotape recording of televised images of the seafloor at the identified area on a spacing defined by the Supervisor.
        ii. Color and/or black/white photography as specified in (a)i., above.
        iii. Direct observation from submersibles, by divers, etc.
    (b) Physical sampling - Sampling at random locations over the the identified area by one or more of the following:
        i. Drags and dredges
        ii. Grab or snapper samples
        iii. Core samples
        iv. Trawl or net hauls
        v. Baited traps or lines

C. Interpretation

The preliminary surveys shall be interpreted for the presence of "live" or hard bottoms. All seafloor features delineated shall be illustrated on a map showing their exact location and size. This includes rock outcrops, coral growths (live or relict), biotic growths and any other anomalies on record. All indications of schools of fish or other biotic communities should be indicated.

D. Anomalies

When an assessment of preliminary and subsequent surveys document the presence of a "live" or hard

bottom, the lessee will take one of the following actions as directed by the Supervisor:

(1) Relocate operations to avoid the live bottom area.
(2) Shunt or transport all drilling fluids and cuttings to avoid the live bottom area, and/or monitor the live bottom areas to ascertain the impact of operations and assess the adequacy of mitigating measures.
(3) Demonstrate to the satisfaction of the Supervisor that the proposed operations will not endanger the resource.
(4) Such other action as deemed necessary by the Supervisor.

III. Reports

A copy of the maps, reports and logs as required under Notice to Lessees 78-2 and as follows shall be submitted prior to or with the Exploratory Plan to the District Supervisor.

A. Summary Report

A summary report shall be prepared which discusses the survey conducted and all areas of "live" or hard bottoms and features as defined in II.C. above including the extent and nature of the "live" or hard bottom. Contour interval shall be 1 m or an interval capable of delineating features of the "live" or hard bottom. Sediment thickness shall be contoured on a 2 m interval or an interval capable of showing features in the upper 30 m of sediment. The map(s) required in II.C. shall be submitted in triplicate.

B. Photo Documentation

Where a "live" or hard bottom has been defined and photo documentation has been required, copies of all photo documentation with identification of any species present shall be submitted.

C. Sampling

Where a "live" or hard bottom has been defined and physical sampling has been required a summary of all species taken, including number, physical size and whether juvenile or adult stages. Identification and classification of all rock fragments or sand samples retrieved will be required.

IV. Cancellation

This Notice to Lessees is supplemental to Notice to Lessees No. 78-2, Subject: Minimum Requirements for Site Surveys, and affects no other previous or current Notices. This Supplement is effective until cancelled or superceded.

December 1, 1978
Effective Date

William S. Cook
William S. Cook
Acting Atlantic Area Oil and Gas Supervisor for Operations

November 30, 1978
Approved

Hillary A. Oden
Hillary A. Oden
Acting Chief, Conservation Division

APPENDIX I

DEEPWATER TECHNOLOGY

APPENDIX I

DEEPWATER TECHNOLOGY

A general discussion of industry deepwater capabilities was presented in Appendix 6 of the Final Draft Environmental Statement for the Proposed Five-Year OCS Oil and Gas Lease Schedule - March, 1980 - February, 1985. This discussion is an update to that appendix. Much of the information in this update was taken from "Proceedings of a Conference, December 6, 1979," entitled "OCS Frontier Technology" conducted by the Marine Board, Assembly of Engineering, National Research Council at the National Academy of Sciences, Washington, D.C. For more complete discussion of deepwater technology, please refer to these two documents.

As the need for new sources of oil and gas increases, the necessity for exploration in deeper and more hostile environments becomes inevitable. Oil and gas development in these environments will require the use of new equipment suitable for working at such depths; however, the major factor determining the ability to produce oil and gas in deep water is economics. In order to justify the drastically increased cost of operating in deeper water, substantial reserves must be found. Drilling of exploratory wills to date has been limited to water depths shallower than 1,486 m.

The rigs most commonly used for exploratory drilling are drill barges, jack-ups, semi-submersibles, and drill ships. Drill barges are most commonly used in inland waters and shallow offshore waters. Jack-up rigs are limited in water depth by the length of the legs. Semi-submersibles and drill ships are most commonly used for deep water drilling.

When drilling in deep water, the riser itself presents some special problems, and is partially a limiting factor in deep water exploratory drilling capability. The riser is connected to the subsea wellhead through a ball-joint, which allows up to 5^{o} of angular movement of the riser with respect to the wellhead. In general, operations are terminated if the ball-joint angle exceeds 3.5^{o}. In deep water, the marine riser must support the column of heavy drill mud inside it, and therefore very strong and heavy pipe is required. Since the riser must be kept in tension to prevent buckling, special adjustable floatation elements are attached to the riser and much of the weight may be supported by a riser tensioning system located on the drilling vessel. To allow for the up and down movement of the waves, the riser is equipped with with slip-joints, and the riser tensioning system and guidelines leading to the blow-out preventor on the seafloor are equipped with heave compensators.

Deep water drilling in strong currents presents more potential problems. In 1978 Sedco's drillship SEDCO 472, completed an exploratory drilling program for Esso Exploration in a deep water area off the northern coast of South America where the South Equatorial Current flows from east to west approximately parallel to the coastline. The deepest water depth drilled was 1,200 m and currents of 3 knots were encountered. In order to successfully complete the drilling program, an intensive research and engineering effort was undertaken to solve some new problems that this environment presented. The results were presented by Shanks, et al., 1979.

The first problem was the possibility of riser recoil. Floating drilling vessels, and particularly those which are dynamically positioned, incorporate an emergency disconnect sequence to allow the vessel to disconnect the riser from the blow-out preventor (BOP) at the seafloor. The sequence takes approximately 30 seconds, during which time the the well is closed off and the choke and kill stabs, etc., are retracted. Tension is maintained on the entire riser string during drilling to prevent buckling due to compression. Furthermore, the riser is kept at approximately neutral buoyancy. If the riser were not controlled during disconnect, it would be drawn upward until the slip-joint collapsed and the energy would then be transferred by impact to the structure of the drilling vessel. To prevent this sequence from occurring, a system of valves and accumulators were added to the existing tensioner system which creates a closed system. Initial pressures are added to the system to balance the weight of the riser so that the system comes into equilibrium shortly after the riser has lifted off the BOP. Once lift-off has occurred, a "cushion" is provided to reduce stressed on the riser caused by the up and down motion of the vessel in the waves.

The next problem was to minimize stress in the riser caused by current. Computer runs showed that a high-stress area appears in the marine riser just below the water surface. This is usually where the current is greatest and produces the greatest action on the riser. Bending moments result which are strong enough to cause concern. To alleviate this threat, a flex joint was added to the riser just below the slip joint and flexible hoses were installed to allow the choke and kill lines, and hydraulic supply lines to bypass the flex joint. In addition to relieving this stress the flex joint could prevent loss of the riser should the angle of deflection in the riser become so great as to cause it to contact the sides of the moonpool.

Were the riser to contact the sides of the moonpool, the riser could not be raised or lowered without damaging the riser buoyancy material. As a remedy for this problem, a structure was installed below the rig floor at the moonpool level. This structure, called a riser restraint system, pivots, slides forwards and backwards and is capable of providing a force on the riser in the direction of the center of the moonpool. Axles, with four pairs of 41-inch diameter trunk tires, were mounted on the structure. The top pair was mounted such that the center of pair coincided with the centerline of the riser. Two pairs were mounted 1.1 m below the top pair, and were mounted to make a 45^{o} angle to each side of the upper pair. The bottom pair was mounted 2.2 m below the middle pair and in line with the upper pair. The objective of this system was not to keep the riser in the center of the moonpool, but rather to keep the angle low enough to prevent damage to the buoyancy modules and keep the load applied to the riser within acceptable limits.

Reconnection of the upper part of the BOP (upper stack), to the lower stack after the disconnect sequence was another problem caused by current. A guideline less system was used in this program along with a tool called a Latch Bumper Head (LBH). A simplified version of re-entry procedure in high current conditions is described as follows:

> First, the lower marine riser package, riser, and slip joint are run and suspended from the riser tensioners. The LBH is made up and run inside the riser, and a television/sonar tool is run and landed in the LBH. The BOP is located with the sonar/television tool and, since the riser string is deflected by the current, the LBH and lower marine riser assembly is positioned over the BOP stack funnel by maneuvering the drillship. As the riser assembly approaches the BOP, the LBH is lowered on the running string until it stabs into and engages the marine riser mandrel, and automatically locks into place. The riser assembly is then lowered on the tensioner until it is within about 3 m. Using external stack-mounted TV, and prior orientation of the riser with respect to the ship at a given heading, the riser is rotated until final alignment with the BOP stack is achieved. The riser package is then lowered into place with the tensioners and hydraulically locked into place. The television and LBH are then recovered and drilling can commence.

Finally, a subsea choke was developed which puts the well control choke manifold on the first joint of riser above the BOP and eliminates the adverse effects of trying to control a well through thousands of feet of small diameter pipe.

As technology advances, deep water exploration drilling records are being broken almost yearly. In 1969, Exxon drilled several wells in waters deeper than 300 m, one of which was in almost 400 m of water off California. In 1970, Exxon drilled another well off California in 456 m. Shell, in 1974, broke Exxon's record with a well drilled off Gabon in some 633 m of water. Shell drilled another well in the same area at a depth of 698 m in 1975. Then in 1976, the depth record was extended to 1,055 m by Esso Exploration off Thailand. In 1977, Esso Exploration broke their own depth record with a well drilled off Surinam in 1,204 m. Getty, as operator for the Seagap Group and Hydro-Congo, extended the depth record to 1,325 m off the coast of Congo in 1978. Again in 1979, Getty established a new record with a well in the Mediterranean off Barcelona, Spain, in 1,353 m using the drillship DISCOVERER SEVEN SEAS. Getty's record did not last for long. On April 28, 1979, Texaco, along with several other companies, spudded in a well with the DISCOVERER SEVEN SEAS in 1,486 m of water off St. Johns, Newfoundland. This record still stands.

Two methods of production are possible in deepwater. One concept utilizes subsea completions and the other uses complaint platforms.

Subsea completions may be necessary in water depths too great for conventional platforms, and perhaps for some complaint structures. Subsea completions also augment conventional platforms by: 1) developing parts of smaller structures and allowing gas or water injection in the periphery of a structure; 2) allowing the development of fields not economically viable with a conventional platform; and 3) providing early production allowing improved initial cash flow.

The first known underwater completion in North America was made in 1943 in Lake Erie. Since then over 300 subsea completions have been made in Lake Erie in less than 26 m of water. Subsea production technology has been under development since the early 1960's in the Gulf of Mexico. These wells are controlled by hydraulic or electrohydraulic systems, serviced with pressure activated tools through the flowline, and have downhole automatic shut-in systems. Between 1960 and 1974, 106 subsea completions were made worldwide.

There are two types of subsea completions now in use in deepwater. The first type, called a wet tree, consists of the wellhead standing on or below the ocean floor on a template. The second system consists of a wellhead enclosed in a chamber at one atmosphere of pressure. The chamber allows a man to work on the well in a shirt sleeve environment. The advantage of the dry completion is that well control lines and the flowline can be connected from inside the chamber. The wet tree requires connections to be made on the outside by a diver, submersible, or a surface guide line; a costly proposition in deep water. The depth of water is not a critical factor in the dry completion because theoretically the wall thickness of the chamber can be increased to withstand greater pressures.

The world deep water record for commercial wellhead completions is now claimed by Lockheed Petroleum Services, Ltd. when they placed a one-atmosphere subsea wellhead at a depth of 189 m in the Garupa Field offshore Brazil.

For production to be brought to the surface for shipment by tanker, special treatment and handling equipment may be required and some type of platform may be necessary at the site.

In shallow waters, conventional platforms have become the industry standard for production. From these platforms a number of wells are typically drilled and the well head completions are on the platform and not on the seafloor. The maximum depth to date for the installation of a conventional platform is 312 m by Shell Oil Company's 46,000 ton Cognac platform 24 km south of the mouth of the Mississippi River. The platform stands 386 m above the seafloor and 73 m above the surface of the ocean. It will have a record 62 wells. The base section was installed during the summer and fall of 1977. The other two sections were installed in the summer of 1978. Initial production began in late 1979 and development drilling continues to date.

As water depth increases, the amount and cost of materials for construction of a conventional platform increase almost exponentially. Therefore, the economic water depth limitation of conventional structures is 400-450 m.

In an effort to reduce the amount of steel required, and thereby the price, Exxon has gone to a design for a guyed tower. This structure is bottom supported and is held upright by guy wires. The moorings are designed for the life of the structure (a minimum of 20 years) and are designed so that a number of the guys could be severed and it would still maintain structural integrity. The deck of the structure would be able to move up to 40% of the wave displacement (2-3 m in a storm). In October 1975, Exxon installed a one-fifth scale model of a guyed tower in 100 m of water off Grand Isle, Louisiana. The tower was highly instrumented and over two years of data confirm that the guyed tower is a feasible and practical platform concept for water depths of 200 to 600 m.

Exxon is now designing a guyed tower for installation in Mississippi Canyon Block 280 in the Gulf of Mexico in more than 300 m of water. The platform, when completed in 1983, will stand some 400 m tall (including the derrick) and will contain 54 well slots. It will have twenty 5-inch guy lines arranged symmetrically around the tower and the total weight, including the guying system and anchor piles, is estimated at 43,000 tons. Total investment of the project is expected to be around $500 million.

Another promising concept in production facilities for deep water is the tension leg platform (TLP). The TLP is a floating structure which is held down by essentially vertical tension members which remain in tension regardless of cyclic loads due to current, wind and waves. This design is also a complaint structure; it is able to move with waves and currents to a tolerable extent. In 1975, Deep Oil Technology, Inc., installed a prototype instrumented TLP in some 60 m of water off California. Results of the test were very favorable.

Conoco is planning to begin construction of a tension leg platform in 1981 for installation in the Hutton Field in the North Sea. Water depth at the site is only 148 m, but the designers feel the TLP would be effective in waters as deep 600 m. This TLP is similar to a large semi-submersible above water. Flotation is divided into many compartments to control inadvertant flooding. A bilge and ballast system will monitor ballast in the compartments and adjust load distribution. The structure will be held in place by 12 mooring lines made of heavy-walled steel tubing similar to drill pipe, three of which will be connected to each of the four corner columns. Each line will hold 880 tons of tension, eliminating vertical movement. Flexible joints will allow some 15 m of lateral movement during storms. The well heads will be placed on the cellar deck of the TLP, similar to conventional platforms. This TLP has 32 well slots, but only 24 are planned for initial development - 13 for production and 11 for water injection (Oil & Gas Journal, 1980).

To bring production ashore, or to transport it to remote surface loading facilities, pipelines are a necessity. Several methods of pipe laying are currently in use and some offer potential for adaption to deep water.

ETPM has developed a method for laying pipe up to 42-in diameter in 1,000 m of water. This method is called RAT for *Remorquage* (towing), *Aboutage* (connecting), and *Tension*. Strings of pipe up to 1,000 m long are assembled on shore and fitted with buoyancy tanks. The strings are then towed to the laying site and connected by passing over a special dynamically positioned lay barge. They are then laid in a conventional manner. The method has been tested in the North Sea laying 42-in pipe in 250 m of water.

Although reel-type pipelaying has been in use for many years (since World War II). Santa Fe Engineering and Construction Company has constructed the first reel-type pipelaying ship, *Apache*, which is self-propelled and uses dynamic positioning. The pipe is welded together on shore, spooled onto a large reel, and rolled off at the site. The *Apache* is able to hold up to 50.5 mi of 4-in pipe, 5.7 mi of 16-in pipe, or various sizes in between. It is able to lay 16-in pipe in water depths around 610 m and smaller lines in water depths of 915 m. With smaller portable reels, it can lay a bundle of several pipes at one time.

Conventional and semi-submersible lay barges are currently operating in depths of more than 610 m. A 30-inch pipeline is now in the planning stages to run from Algeria to Spain in the Mediterranean Sea, where water depths are greater than 1900 m. The vessel has been designed for the job.

Oil and gas operations in ever greater water depths require the use of new and more economical production systems. Subsea completion and platform technology is being tested in shallow depths to provide procedures to be used in very deep water. All industry experts agree that if given the necessary economic incentives, the technology will be available. A secondary result of subsea completion and production technology is the ability to develop small reservoirs without the expenditures required for surface structures. As the price of oil increases on the world market, the feasibility to utilize more sophisticated production systems in deeper waters will be realized.

In summary, the exploration well drilled in deepest water was drilled in 1,486 m of water off Newfoundland, and the industry presently has the capability to drill in water depths to about 2,400 m. Several wells have been drilled worldwide in water as deep as 1,200 m with currents up to 3 knots. Research is currently being conducted by several major oil companies and projections from such research are that within 5 years, technology will permit drilling in water depths to 3,000 m. The deepest commercial discovery to date is in 671 m of water off Spain, but was of insufficient quanitity to justify development. The deepest commercial wellhead completion is a dry completion in 189 m in the Garupa Field off Brazil. The deepest wet tree subsea completion is in 146 m in the North Sea. A general concensus in the oil industry, however, is that they can presently produce in up to 1,200 m of water and that within 10 years, they will have the technology to produce in over 1,800 m of water.

APPENDIX J

LIST OF VISUALS

APPENDIX J

VISUALS FOR PROPOSED SALE 56

Abbreviations

Units Of Measure

A/M

ABBREVIATIONS

BAST	Best Available and Safest Technology
BLM	Bureau of Land Management
BP	before present
Btu	British thermal unit
CEI	Coastal Environments, Inc.
CEIP	Coastal Energy Impact Program
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNA	Center for Natural Areas
CZMA	Coastal Zone Management Act
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI (also: USDI)	U.S. Department of the Interior
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FCMA	Fishery Conservation and Management Act
FCZ	Fishery Conservation Zone
FEIS	Final Environmental Impact Statement
FMC	Fishery Management Council
FMP	Fishery Management Plan
FR	Federal Register
FWPCA	Federal Water Pollution Control Act
FWS	U.S. Fish and Wildlife Service
GS (also: USGS)	U.S. Geological Survey
GSA	General Services Administration
ICC	Interstate Commerce Commission
IPP	Intergovernmental Planning Program
LOOP	Louisiana Offshore Oil Port, Inc.
LWCF	Land and Water Conservation Fund
MAFLA	Mississippi, Alabama, Florida
MMA	Marine Mammal Act
MOU	Memorandum of Understanding
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Survey
NPDES	National Pollutant and Discharge Elimination System
NTL	Notice to Lessees
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OCSLAA	Outer Continental Shelf Lands Act Amendments
OCZM	Office of Coastal Zone Management
PL	public law
SAB	South Atlantic Bight
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SCUBA	Self Contained Underwater Breathing Apparatus
SIC	Standard Industrial Classification
SPCCP	Spill Prevention, Control, and Countermeasure Plan
SUSIO	State University System Institute of Oceanography
USDC	U.S. Department of Commerce
USDI (also: DOI)	U.S. Department of the Interior
USGS (also: GS)	U.S. Geological Survey
UTM	Universal Trasverse Mercator

UNITS OF MEASURE

a	acre
bbl	barrel
bpd	barrels per day
Btu	British thermal unit
C	Celsius
cm	centimeter
cm/sec	centimeters per second
^{o}	degree
F	Fahrenheit
ft/century	feet per century
ha	hectare
kHz	kilohertz
km	kilometer
km^2	square kilometer
km/h	kilometer per hour
kt	knot
l	liter
m	meter
m^3	cubic meter
mi	mile (statute)
mmb	million barrels
mmcfd	million cubic feet per day
mmmcf	billion cubic feet
mph	miles per hour
nmi	nautical mile
nmi^2	square nautical mile
ppm	parts per million
ppt	parts per thousand
t	ton (2,000 lbs)
ug/l	micrograms per liter

NEW ORLEANS
Outer Continental
Shelf Office
BLM Special Information
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

NOTICE OF AVAILABILITY
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Enclosed for your review and comment is a copy of the draft environmental impact statement (DEIS) prepared on proposed South Atlantic OCS oil and gas Lease Sale No. 56 which is tentatively scheduled to be held in August, 1981.

Lease offerings under consideration include 286 tracts offshore the states of North Carolina, South Carolina, Georgia and Florida. These tracts are summarized by location, area, distance from shore, and water depth in Appendix A (page 195). The tracts range from 16 - 111 nmi from shore and 20 - 2100 m in depth.

The Bureau of Land Management has prepared this DEIS to fulfill its responsibilities under the National Environmental Policy Act of 1969, and has complied with the new procedural regulations of the Council on Environmental Quality. The statement is based upon data and information available in this office, and also supplied by, and in consultation with, other federal, state, and local agencies; oil and gas companies; and interested private organizations and citizens.

Public hearings pertaining to this proposed action will commence at 9:00 a.m. each morning on September 3, 1980, at the Wilmington Hilton Inn, 301 N. Water Street, Wilmington, North Carolina and on September 5, 1980, at the Jacksonville Hilton, 565 S. Main Street, Jacksonville, Florida. We would appreciate receiving your comments concerning the proposed action by September 12, 1980. Comments received after the established review period will be considered in the subsequent decision process, even though the comments may be received too late for inclusion in the final statement.

Hale Boggs Federal Building, Suite 841, New Orleans, Louisiana 70130

FINAL 5-YEAR OCS OIL & GAS LEASING SCHEDULE

JUNE 1980

PROPOSED SALE AREA	PROPOSED DATE	1980 J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico	9/80		F			P	Sc	R	N	S			
55 Gulf of Alaska	10/80			F		P		Sc	R	N	S		
62 Gulf of Mexico	11/80		F				P		Sc	R	N	S	
53 Central N. Calif.	5/81				E		H			F	P		
RS-1 Reoffering Sale	6/81												
A66 Gulf of Mexico	7/81							E		H			F
56 South Atlantic	8/81							E		H			
60 Cook Inlet	9/81								E		H		
66 Gulf of Mexico	10/81							E		H			F
59 Mid-Atlantic	12/81											E	
67 Gulf of Mexico	3/82	C		D		T							
RS-2 Reoffering Sale	6/82												
68 Southern California	6/82		D			T							
69 Gulf of Mexico	8/82	C		D		T							
57 Norton Basin	9/82		T										
52 North Atlantic	10/82		D				T						
70 St. George Basin	12/82		T										
71 Beaufort Sea	2/83			T									
72 Gulf of Mexico	3/83												
61 Kodiak	4/83									C		D	
73 California	5/83											C	
RS-3 Reoffering Sale	6/83												
74 Gulf of Mexico	9/83												
75 No. Aleutian Shelf	10/83					C			D				T
76 Mid-Atlantic	11/83												
78 South Atlantic	1/84												
79 Gulf of Mexico	3/84												
RS-4 Reoffering Sale	5/84												
80 California	6/84												
81 Gulf of Mexico	7/84												
82 North Atlantic	10/84												
83 Navarin Basin	12/84												
84 Gulf of Mexico	1/85												
☆85 Chukchi Sea	2/85												
86 Hope Basin	5/85												
RS-5 Reoffering Sale	6/85												

PROPOSED SALE AREA	1981 J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico												
55 Gulf of Alaska												
62 Gulf of Mexico												
53 Central N. Calif.		Sc	R	N	S							
RS-1 Reoffering Sale	P		Sc	R	N	S						
A66 Gulf of Mexico		P		Sc	R	N	S					
56 South Atlantic	F		P		Sc	R	N	S				
60 Cook Inlet		F		P		Sc	R	N	S			
66 Gulf of Mexico					P		Sc	R	N	S		
59 Mid-Atlantic	H				F		P		Sc	R	N	S
67 Gulf of Mexico			E		H			F		P		Sc
RS-2 Reoffering Sale												
68 Southern California					E		H				F	
69 Gulf of Mexico			E		H			F				
57 Norton Basin						E				H		
52 North Atlantic									E		H	
70 St. George Basin										E		
71 Beaufort Sea												E
72 Gulf of Mexico	C		D		T							
61 Kodiak		T										
73 California	D			T								
RS-3 Reoffering Sale												
74 Gulf of Mexico	C		D		T							
75 No. Aleutian Shelf												
76 Mid-Atlantic					C		D			T		
78 South Atlantic			C			D				T		
79 Gulf of Mexico												
RS-4 Reoffering Sale												
80 California										C		D
81 Gulf of Mexico												
82 North Atlantic												
83 Navarin Basin						C			D			
84 Gulf of Mexico												
☆85 Chukchi Sea							C			D		
86 Hope Basin									C			D
RS-5 Reoffering Sale												

PROPOSED SALE AREA	1982 J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico												
55 Gulf of Alaska												
62 Gulf of Mexico												
53 Central N. Calif.												
RS-1 Reoffering Sale												
A66 Gulf of Mexico												
56 South Atlantic												
60 Cook Inlet												
66 Gulf of Mexico												
59 Mid-Atlantic												
67 Gulf of Mexico	R	N	S									
RS-2 Reoffering Sale		P		Sc R	N	S						
68 Southern California	P		Sc	R	N	S						
69 Gulf of Mexico			P		Sc	R	N	S				
57 Norton Basin		F		P		Sc	R	N	S			
52 North Atlantic			F		P		Sc	R	N	S		
70 St. George Basin	H				F		P		Sc	R	N	S
71 Beaufort Sea			H				F		P		Sc	R
72 Gulf of Mexico			E		H			F		P		Sc
61 Kodiak			E			H			F		P	
73 California				E		H				F		P
RS-3 Reoffering Sale												
74 Gulf of Mexico			E		H			F				
75 No. Aleutian Shelf								E			H	
76 Mid-Atlantic										E		H
78 South Atlantic											E	
79 Gulf of Mexico	C		D		T							
RS-4 Reoffering Sale												
80 California			T									
81 Gulf of Mexico	C		D		T							
82 North Atlantic				C		D			T			
83 Navarin Basin	T											
84 Gulf of Mexico											C	
☆85 Chukchi Sea		T										
86 Hope Basin				T								
RS-5 Reoffering Sale												

PROPOSED SALE AREA	1983 J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico												
55 Gulf of Alaska												
62 Gulf of Mexico												
53 Central N. Calif.												
RS-1 Reoffering Sale												
A66 Gulf of Mexico												
56 South Atlantic												
60 Cook Inlet												
66 Gulf of Mexico												
59 Mid-Atlantic												
67 Gulf of Mexico												
RS-2 Reoffering Sale												
68 Southern California												
69 Gulf of Mexico												
57 Norton Basin												
52 North Atlantic												
70 St. George Basin												
71 Beaufort Sea	N	S										
72 Gulf of Mexico	R	N	S									
61 Kodiak	Sc	R	N	S								
73 California		Sc	R	N	S							
RS-3 Reoffering Sale		P		Sc R	N	S						
74 Gulf of Mexico				P		Sc	R	N	S			
75 No. Aleutian Shelf			F		P		Sc	R	N	S		
76 Mid-Atlantic				F		P		Sc	R	N	S	
78 South Atlantic		H				F		P		Sc	R	N
79 Gulf of Mexico			E		H			F		P		Sc
RS-4 Reoffering Sale												
80 California					E		H				F	
81 Gulf of Mexico			E		H			F				
82 North Atlantic									E		H	
83 Navarin Basin										E		
84 Gulf of Mexico	D		T									
☆85 Chukchi Sea												E
86 Hope Basin												
RS-5 Reoffering Sale												

PROPOSED SALE AREA	1984 J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico												
55 Gulf of Alaska												
62 Gulf of Mexico												
53 Central N. Calif.												
RS-1 Reoffering Sale												
A66 Gulf of Mexico												
56 South Atlantic												
60 Cook Inlet												
66 Gulf of Mexico												
59 Mid-Atlantic												
67 Gulf of Mexico												
RS-2 Reoffering Sale												
68 Southern California												
69 Gulf of Mexico												
57 Norton Basin												
52 North Atlantic												
70 St. George Basin												
71 Beaufort Sea												
72 Gulf of Mexico												
61 Kodiak												
73 California												
RS-3 Reoffering Sale												
74 Gulf of Mexico												
75 No. Aleutian Shelf												
76 Mid-Atlantic												
78 South Atlantic	S											
79 Gulf of Mexico	R	N	S									
RS-4 Reoffering Sale	P		Sc R	N	S							
80 California	P		Sc	R	N	S						
81 Gulf of Mexico		P		Sc	R	N	S					
82 North Atlantic			F		P		Sc	R	N	S		
83 Navarin Basin	H				F		P		Sc	R	N	S
84 Gulf of Mexico	E		H			F		P		Sc	R	N
☆85 Chukchi Sea			H				F		P		Sc	R
86 Hope Basin			E			H				F		P
RS-5 Reoffering Sale												

PROPOSED SALE AREA	1985 J	F	M	A	M	J	J	A	S	O	N	D
A62 Gulf of Mexico												
55 Gulf of Alaska												
62 Gulf of Mexico												
53 Central N. Calif.												
RS-1 Reoffering Sale												
A66 Gulf of Mexico												
56 South Atlantic												
60 Cook Inlet												
66 Gulf of Mexico												
59 Mid-Atlantic												
67 Gulf of Mexico												
RS-2 Reoffering Sale												
68 Southern California												
69 Gulf of Mexico												
57 Norton Basin												
52 North Atlantic												
70 St. George Basin												
71 Beaufort Sea												
72 Gulf of Mexico												
61 Kodiak												
73 California												
RS-3 Reoffering Sale												
74 Gulf of Mexico												
75 No. Aleutian Shelf												
76 Mid-Atlantic												
78 South Atlantic												
79 Gulf of Mexico												
RS-4 Reoffering Sale												
80 California												
81 Gulf of Mexico												
82 North Atlantic												
83 Navarin Basin												
84 Gulf of Mexico	S											
☆85 Chukchi Sea	N	S										
86 Hope Basin		Sc	R	N	S							
RS-5 Reoffering Sale		P		Sc R	N	S						

U.S. DEPARTMENT OF THE INTERIOR
March 3, 1849

Cecil D. Andrus
Secretary of the Interior

C - Call For Nominations
D - Nominations Due
T - Tentative Tract Selection
E - Draft Environmental Statement
H - Public Hearing
F - Final Environmental Statement
P - Proposed Notice of Sale
Sc - State Comments Due
R - Energy Review
N - Notice of Sale
S - Sale

☆ The holding of the Chukchi Sale at this time is contingent upon a reasonable assumption that technology will be available for exploration and development of the tracts included in the sale.

INT 4012-80